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ICE MAKING AS A MEANS OF IMPROVING THE LOAD FACTOR OF CENTRAL STATIONS.

Much attention has been given by electrical engineers and central-station managers to means of improving the load factor of electrical generating plants, seeking to shorten and fill in the ordinarily long "valley-load" period, during which a large part of the plant investment lies idle. It has been recognized that the lying idle, during so large a part of each twenty-four hours, of the large amount of machinery required to deliver the maximum demand, and representing invested capital, has a serious influence on rates.

Hitherto, however, on account of the time of day during which electricity is not required in any amount at all proportionate to the capacity of the station, the plant thus released has not been available for any other purpose. It has been proposed, and tried, to utilize the exhaust steam of power stations for heating; but heat is not required during the period of low-valley load, say, from as late as 10:30 in the evening to 6 o'clock in the following morning. The world is, for the most part, asleep during these hours, and does not have to be warmed, does not have motors running or electric heating devices turned on—does not engage in any activity, any more than it needs electric light to any great extent.

In the earlier days of electrical engineering, with direct current, it was proposed to level down the peak loads and level up the valley loads on the machinery installed by the employment of storage batteries; the object being to carry a given average and maximum demand with a plant of electrical machinery having a capacity for delivering the average demand only, instead of being obliged to provide a plant of running machinery capable of delivering the maximum demand. The introduction of alternating current, however, with its numerous advantages for efficient transmission and distribution of power, has retarded the installation to some extent of large storage batteries. Therefore, the need is still unmet for a practicable industrial utilization of the power plant—engines, turbines, or waterwheels—that can keep the plant profitably busy running night and day.

It is suggested that the manufacture of artificial ice might be in a measure a solution of this problem. Electricity supply and ice manufacture are both public-service operations, hence it seems logical to carry them on, where practicable, with the same central-station plant. To be able to transmute the interest now drawn by idle machinery, which is a serious and

regrettable loss, into a profit from a marketable product like pure ice, is certainly a consummation to be desired.

The ideal system would be a flexible one in that the rate at which power would be absorbed by the use of the ice-making apparatus would not need to be uniform, but could conform to the available power supply. Ice of marketable thickness would have to be made in the time available—*i. e.*, in the eighteen to twenty hours out of the twenty-four during which the full capacity of the power plant is not required for the generation of electricity for the ordinary uses. Attainment of these features would mean that ice-making would supplement the present function of the power station and increase the dividend on invested capital by rendering the station machinery a continuously profitable installation, instead of an installation earnings profits during a fraction of each twenty-four hours only, and running at a loss for the remainder of the time.

COTTON-MILL LOADS.

Few industries furnish as uniform a load and as high a load factor as cotton mills, on electrical supply systems.

A case in point is that of a New England cotton mill that is driven by power from a central station, and has electric motors of 817 aggregate horsepower. During a recent year this cotton mill consumed 1,187,000 kilowatt-hours of metered energy, or 1,452 kilowatt-hours per motor horsepower. If this mill operated 2,500 hours during the year, the average load was 475 kilowatts, or 0.58 kilowatt per horsepower of motor rating.

A cotton mill in South Carolina with a motor equipment of 445 horsepower consumed 84,450 kilowatt-hours during the twenty-six week days of one month, with 271.5 hours of operation. This record shows an average load of 311 kilowatts during the working hours of the month, or 0.7 kilowatt per horsepower of the connected motors.

On each of the twenty-six working days of the month the average consumption of energy at the above mill was 3,248 kilowatt-hours, while the largest consumption on any one of these days was 4,500 kilowatt-hours, and the least was 1,650 kilowatt-hours, during the six hours' work of a Saturday. This largest consumption of 4,500 kilowatt-hours during a day of eleven-and-one-fourth hours amounts on an average to a load of 400 kilowatts, or to nearly 0.9 kilowatt of load per horsepower of the motor equipment.

On the basis of this largest average load of 400 kilowatts for one day, the average of 311 kilowatts for the month shows a load factor of 77.7 per cent.

At a smaller mill, in North Carolina, during the twenty-six working days of another month, the consumption of energy from the electric line was 57,920 kilowatt-hours, and the total hours of operation were 266, so that the average load was 217 kilowatts for the working hours.

Like the mill in South Carolina, the one under consideration operated only to noon on Saturdays, and the consumption on one Saturday was only 1,350 kilowatt-hours. The greatest consumption on one day was 2,530 kilowatt-hours, corresponding to an average load of 230 kilowatts during the eleven hours of operation.

On the basis of 230 kilowatts as the largest average load on one day, the average load of 217 kilowatts for the month gives a load factor of 94.3 per cent. This is certainly a high figure, but the maximum load of the month was no doubt greater than the average load during the day of greatest consumption, so that the ratio of average to maximum load was less than that just given.

In another cotton mill, located in New England, the total horsepower of the operating motors was 1,365, and the total consumption of energy during 221.5 hours was 202,600 kilowatt-hours, corresponding to an average load of 914 kilowatts. Per motor-horsepower this average load amounts to 0.67 kilowatt. The 221.5 hours of operation occurred during four weeks, and during the week of largest energy consumption the average load for fifty-eight hours was 958 kilowatts, the largest average for either week. Of this largest average load the average for the four weeks was 95.4 per cent.

To secure these large cotton-mill loads it is necessary to make very low rates for electric energy. In the New England mill above mentioned, where the annual consumption was 1,187,000 kilowatt-hours, the rate was 1.8 cents per kilowatt-hour, and the income of the electric station from that mill was thus $21,366 during the year. Good steam coal costs about $4.25 per long ton in carload lots in the city where this last-named mill and the central station that generates the power are located, and the central station operates with steam power exclusively.

In another New England textile mill that operates with electric power from a central station the total motor equipment was 746 horsepower, and the rate paid about one cent per kilowatt-hour. The energy in this case, however, was developed mainly by waterpower. A very large cotton-mill plant in Canada got its power from a hydroelectric supply system at 0.572 cent per kilowatt-hour. The cotton mills of North and South Carolina above mentioned are in a region where hydroelectric power is frequently sold to small mills as low as 0.8 cent per kilowatt-hour, and the cotton mills form much the largest single load of the electric system.

A FIELD FOR TRACKLESS TROLLEYS.

Trackless-trolley vehicles could find profitable employment on many routes where the stage drawn by horses continues to be the only mode of public conveyance.

Strange as the fact may appear at this late day, there are no less than thirty-six stage routes in regular operation along about two hundred miles of a single steam railroad in New England. These stage routes connect the railroad stations with villages that have neither steam nor electric transportation, and are probably too small in many cases to warrant the construction of standard electric railways.

In length these stage routes are mostly one to eight miles each, though about one-fifth of the total number range from

ten to eighteen miles, and one is twenty-six miles long. Electric railways parallel the stage routes for several miles in some instances, but as the electric cars do not carry baggage, and cover only a part of the distance to the desired destination, the stage gets the traffic.

As a rule, the stages run daily, or daily except Sunday, and make one or two trips per day between the railroad station and the villages to which they go. In a few cases the stage runs only one, two or three days per week, while in one instance, where the route is a mile long and the fare is twenty cents, the stage makes ten trips each way per day. With trackless-trolley transportation at shorter intervals and somewhat lower rates there can be no doubt that the volume of traffic over many of these stage routes would greatly increase.

On most of these stage routes the fare amounts to between five and twelve cents per mile, and the highest rate noted was twenty cents per mile. For a complete single trip of a stage the lowest fare is ten cents, this for a distance of one mile, and in a number of instances the fare is one dollar, while it reaches $1.50 for the twenty-six-mile ride. Per mile of travel, the stage fares amount to between five and twenty times the electric-car fares in the same sections of the state. Moreover, the least unit of fare for any part of the stage journey is often as high as twenty-five cents, and sometimes even more than this.

The trackless trolley is suggested for application on these stage routes because it appears to offer the cheapest and most desirable form of public transportation there, and because in many instances it can be constructed as an extension of an existing electric railway that runs parallel to some part of the stage route, or at least reaches the steam-railroad depot whence the stage starts.

In such a case, the double trolley wires for the trackless electric cars may be merely an extension of conductors from the existing trolley wires and track, and would, of course, take energy from the same generating stations. Such extensions of trackless trolleys from existing electric railways would act as feeders and increase the traffic on the main parts of the system, besides carrying a paying traffic of their own. With power to operate the trackless trolley from a standard electric-railway system, it is hard to see how any form of independent motor car, much less the stagecoach, could successfully compete with it.

Additional advantage on the side of the trackless trolley in comparison with other than electric vehicles may be gained in some cases by operating the direct-current motors at 1,200 volts, which has been found to give quite satisfactory results with standard railway equipments. Trackless-trolley cars in the place of stagecoaches must, of course, earn interest and dividends from a very light traffic, and while the daily expense for labor and power will be small, the investment must be kept as low as practicable. With 1,200 volts between the trolley wires, the entire weight and cost of the overhead structure will, of course, be much less than that necessary for 600-volt work.

It is just this matter of low relative investment that makes the trackless trolley practicable in many situations where a standard electric-railway line cannot hope to earn a fair return. Of course, the most important advantage of the trackless-trolley line as to investment is in the item of roadbed and track, but here it is sufficiently large to greatly extend the area of electric transportation. An example of costs on a recently constructed interurban road shows how large a part of an electric-railway investment often goes into the item of roadbed and track. Figures for an interurban road are taken so as to avoid the large additional expense incident to the construction of electric roadbed and tracks with girder rails in paved city streets.

The electric railway in question is 47.3 miles long, and the second main track and sidings bring the total length of single track up to 78.5 miles. Of the total length of railway, 12.8 miles are located on private right-of-way. For the roadbed, tracks and electric-line construction the cost on this railway was $2,527,887, or $32,202 per mile of single track, not including interest during construction, engineering or incidental expenses.

For the roadbed and tracks alone the cost amounted to $2,211,067, leaving $316,820 as the cost of the poles, trolley wires and feeders, so that the complete overhead construction cost only 14.3 per cent of the amount invested in roadbed and track. Per mile of single track, the complete overhead structure cost $4,036, and per mile of railway line, sixty per cent double track and trolley, the cost was $6,700, compared with $46,745 per mile of line for roadbed and tracks.

Besides the great reduction of necessary investment by the use of the trackless trolley, there is a large saving by avoiding the annual expense of repairs to roadbed and tracks, which amounted to $10,793 and to $8,864, respectively, in the two latest years for which records of these railways are at hand.

It is not meant to suggest that the time has come when the trackless trolley can supplant the electric railway with special roadbed and tracks for heavy and frequent traffic, but simply that the omission of such roadway and tracks makes it practicable to extend the radius of electric traction for light or infrequent traffic.

This view has found favor in Europe, for trackless-trolley lines are in operation at Vienna and a number of other points on the Continent, and are being considered for extensions of the regular tramway systems at various places in the British Isles, notably Birmingham, Leeds and Edinburgh.

THE KILBOURN WATERPOWER DEVELOPMENT.

On other pages of this issue is an illustrated article describing the hydroelectric plant of the Southern Wisconsin Power Company at Kilbourn, Wis. Of particular electrical interest in this installation is the relatively low voltage used on the transmission line in comparison with its length. Although the use of 44,000 volts for the 125-mile line is only temporary, even the ultimate voltage planned, 72,000 volts, seems moderate in view of the success of 110,000-volt systems and the tendency to employ 1,000 volts per mile.

Indiana Electric Light Association.

First Annual Meeting, French Lick Springs, August 18 and 19.

The first annual meeting of the Indiana Electric Light Association was held at the French Lick Springs Hotel, French Lick Springs, Ind., on August 18 and 19. The weather was delightful, and this and the beautiful scenery surrounding the noted resort, not to mention the indefatigable efforts of Fred Leslie, of Muncie, Ind., the genial and popular secretary-treasurer of the association, combined to make the meeting a memorable success in every way, in spite of the comparatively poor attendance of the central-station men.

It may be interesting here to note that the Indiana Electric Light Association was formed last November, and that a meeting was held at Indianapolis, Ind., in January of this year, as already reported in these columns.

The convention was opened on Wednesday afternoon, August 18, at 2:30 p. m., by the president of the association, T. C. McReynolds, of the Kokomo, Marion & Western Traction Company, Kokomo, Ind.

After the secretary had read the minutes of the Indianapolis meeting, the president proceeded to deliver his annual address, an abstract of which follows:

PRESIDENT'S ADDRESS.

The president, in welcoming the delegates to the first annual convention of the association, explained that the world-famous resort of French Lick Springs had been chosen for this meeting to afford those attending a chance to combine a pleasurable vacation with the more serious business of the actual proceedings. Referring to the recent bills affecting electric-light men, which were dropped in the committee stage at the last state legislature, he recommended that the association consider future bills before they were to be taken up again by the legislature. Through the medium of discussion at association meetings members could exchange ideas regarding the investing of their capital to the mutual benefit of all. Meetings of this sort, press reports, etc., were helpful, but not necessary to success. He compared business in the past with that of the present, and pointed out that the per capita consumption of electric current had doubled in recent years and tended still further to increase, while the operating costs had largely decreased. He predicted a phenomenal electrical growth for the future, and said that those in charge of public-utility properties will be expected to develop materially along economical lines with corresponding increases in earnings. To this end the companies must take full advantage of passing opportunities, and employes must be selected with regard to their skill and intellect. A man must not necessarily have had a college training to succeed, although such was an advantage. Energy and push are the chief desiderata. Electrical magazines helped one to keep in touch with current developments, and the interest of members in attending association conventions of this sort afforded the greatest help to the man who would keep abreast of the times.

TOM TAGGART'S ADDRESS.

Following the presidential speech an address of welcome was given by Tom Taggart, the president of the hotel company.

Mr. Taggart said it was a pleasure to meet the association at French Lick. He had heard the preceding address, and heartily concurred in everything that the president had said. He himself had an electric power plant adjacent to the hotel, and could therefore speak with some authority. He insisted that every young man should be qualified to fill the position of trust given him. He believed that every electric-light plant in Indiana should join the association and suggested the inclusion of water and other public-utility companies. In conclusion, he told of some experiments he was conducting with electric batteries, both direct and alternating current, of much potency, some with ice and some without, and invited those present to investigate later for themselves, as his guests.

Mr. Taggart was enthusiastically applauded. He was subsequently made a member of the advisory committee of the association.

SECRETARY-TREASURER'S REPORT.

Fred Leslie, of Muncie, Ind., then presented his report as secretary-treasurer.

Mr. Leslie regretted that more of the company members were not represented at the convention, and that some of them had not attended any of the meetings. He had not had time to go out and make a personal canvass. According to the record there were twenty active members and fifty-two associate members. Collections from dues were the only source of revenue and these amounted to $520. There was a balance of $206.30 up to the time of this convention. In answer to a question he said that about 130 private companies in the state were eligible to active membership.

CENTRAL POWER STATION PRACTICE.

Phil. H. Palmer, of the Kokomo, Marion & Western Traction Company, Kokomo, Ind., then read a highly suggestive paper on "Central Power Station Practice."

The author began by stating that as from sixty to eighty per cent of the total cost of central-station lighting is within the power station, a change in economy in that department figures largely in the lighting company's cost account. Most of the losses occur in the boiler room. These are uncertain, variable, and difficult to locate and remedy, yet time spent in this direction is amply repaid by the better results to be obtained. Recording watt-meters and the weighing of coal, to begin with, will demonstrate in most cases poor records of coal per kilowatt-hour. The author gave an account of the plant of his company which includes two 1,000-kilowatt steam turbines (one being used as a reserve), operating with a twenty-seven-inch vacuum (referred to thirty inches barometer), and having a fifty per cent average daily load factor. Various curves were shown. Illinois slack coal averaging 11,000 British thermal units per pound gave an evaporation not greatly exceeding 5.5 pounds, which showed an efficiency of boilers and furnaces of 57.5 per cent, a fair average for an everyday result. At tempts to burn better coals showed an increased evaporation but a faster rise in price per ton, which proved less economical than the low-priced coal in this particular case. The author pointed out that careless firing was the frequent cause of poor efficiency. The use of a CO_2 recording instrument was then touched upon. If the CO_2 in the breeching is found to contain only five or six per cent of CO_2 an increase in boiler efficiency could usually be effected by trying different manipulations of draft, thicknesses of fire, stopping leaks, etc. With bituminous slack coal an increase of CO_2 from six to eight per cent will ordinarily increase the evaporation about eight per cent; a further increase of CO_2 from eight to twelve per cent will increase the evaporation 4.5 per cent. The best coal for use in a given plant can be determined only by experimentation. Boilers must be kept clean. With hard waters depositing one-sixteenth of an inch of scale in four weeks or less a water-softening apparatus should be installed. In plants where exhaust steam is not in demand it will pay to use electrically-driven pumps for every purpose except boiler feeding. In the engine room the attendants should be accustomed to a variety of shifts so as to be ready to fill different positions in emergencies. The author reviewed the practice in his plant where with thirteen men employed the labor cost was 0.2 of a cent per kilowatt-hour. The cost per ton of coal for handling coal and ashes, and for firing, was twenty-six cents. Pride in employes should be encouraged, and the fact kept in mind that power-plant daily records are as important as office bookkeeping. Too much reliance should not be placed on automatic devices to the exclusion of regular inspection. Uniformly correct voltage at the distribution center must also be insisted upon. Selection of lubricating oil, and its conservation (as by recovering oil from used waste) were important points. Mechanical oil-feeders for feed pumps and other auxiliaries using cylinder oil, were recommended. In keeping the daily log sheet the total load at least in kilowatts should be plotted. Principal records of the station operation should also be included in the log sheet, but not too many detailed records. Boiler and engine-room records should be kept separately, and all records kept for future reference. Some interesting figures were given of the detailed operating costs of various lighting plants. Small plants furnishing from 400 to 800 kilowatt-hours each night gave an operating cost of 2.31 cents per kilowatt-hour at the switchboard. On the other hand, a plant furnishing 40,000 kilowatt-hours per twenty-four hours, with a seventy per cent load factor, gave an operating cost of 0.54 of a cent per kilowatt-hour. The author gave in detail the cost of his company's plant at Kokomo, which gave a cost of 0.72 of a cent per kilowatt-hour for an average of 12,083 kilowatt-hours per day in

the year 1908. In conclusion, the author called attention to the fact that interest and depreciation on a plant investment are no small portion of the expense of producing electricity and in making each addition and improvement these details should be kept thoroughly in mind. He pointed out, finally, that old equipment, if in good condition, was useful for short peak hours and for reserve, and gave figures showing the plant saving per kilowatt-hour which would have to result in order to cancel the interest and depreciation charge on a given investment per kilowatt-hour installed for improvement—a fact often lost sight of in rebuilding and improving plants.

At the conclusion of his paper the author was greeted with a spontaneous and prolonged outburst of applause. A hearty vote of thanks was accorded to him.

In the discussion that followed, Mr. Palmer, in answering several questions, said that Indiana mine-run coal saves about five per cent over Indiana slack, but that the difference in price is more than correspondingly greater. Regarding the thirty-two per cent motor-generator and battery losses of his installation, he had no figures of the details, but said that the combined battery and booster efficiency was eighty per cent.

C. C. Perry, of Indianapolis, remarking on the operating costs cited by Mr. Palmer, said that the station cost is only a small portion of the expense. Interest on investments and office cost, etc., combine to give a much larger cost figure to the company.

C. A. Bookwatter, mayor of Indianapolis, said it does a public official good to go out to meetings of this kind, to meet men trying to please and satisfy the public. In his twenty years of experience he had found that when the public gets tired of kicking an official it gave the public-utility company a turn. A certain newspaper which had raised its advertising rates twice within a year editorially advised the public-utility companies to lower their charges to the public. Indiana was going to have a public-utility bill. Public-utility men have the right to make a fair and legitimate profit, and to this end should see that the drafters of the bill should have the best expert advice possible beforehand. Such a bill could not be other than beneficial to all concerned. Confiscation was unfair to honest business men who had sunk their own capital in their enterprises, and after all the general public is more concerned in obtaining first-class service from first-class plants than in seeing those plants go into the hands of a receiver.

Mr. Palmer said that the members of the association should obtain data like the public-service commissions.

Mr. Bookwatter told of a firm of Chicago engineers that advised one of its clients to buy power from the central-station company because the price would be cheaper than if an isolated plant were installed.

The president said that a public-utility bill will undoubtedly deal with the question of prices.

THE TUNGSTEN LAMP AND ITS LATER DEVELOPMENT.

George S. Merrill, of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, read a paper on "The Commercial Effects of the Tungsten Lamp and Its Later Development."

The reception of the tungsten lamp by those stations whose rates were largely on a kilowatt-hour basis was rather unenthusiastic until the possibility of developing new business by its use became known. The author showed the analogy between the tungsten lamp and the introduction of the Welsbach mantle for gas lighting. He pointed out that the high efficiency of the tungsten makes it possible to secure all kinds of service, whether residential or commercial, which was inaccessible before on account of the prohibitive cost to the consumer. The introduction of the tungsten where electric light was not used before opened new fields for the introduction of other electric devices, all of which tended to improve the load factor. Even by consuming only the same amount of power as before, by distributing part of his former peak-load consumption over the off-peak period, the customer was made more profitable to the central station. Merchants were willing also to use more light and consume as much current as before, or more, on account of the advertising value of the extra light. Mr. Merrill emphasized the importance of using proper fixtures and methods of installation to obtain the greatest effect from the tungsten lamp. By properly attending to this phase of the situation central-station men could transform a dissatisfied customer into an enthusiastic booster. He proceeded to show the development of the incandescent lamp in its relation as a competitor of gas, and demonstrated in detail the adaptability of the various forms of tungsten lamps to all classes of service, showing especially the advantages of the tungsten street series lamp over its competitors. These advantages are its capability for artistic arrangement, its small depreciation in efficiency, the constancy and quality of the light, and the ease with which it may be controlled from some central point. He further went on to expound the possibilities of the low-voltage, four-candlepower lamp in outdoor decorative lighting, recommending the use of special transformers for this class of work. Some practical pointers on the installation of these lamps were given in detail. In conclusion, the author referred to the advantages of the tungsten lamp in sign lighting (this preferably on a flat-rate basis), train lighting, and automobiles, in fact in every case where an economical and convenient unit of moderate size is required, particularly where a light of a good color is desired.

A spirited discussion followed.

George C. Osborne, of the General Electric Company, Harrison, N. J., gave some figures relating to the consumption of gas for lighting in Massachusetts. Nine billions of cubic feet of gas are used annually, two-thirds of this for lighting. The total gas used is equivalent to 97,000,000 kilowatt-hours. A good deal of this business should be captured for electrical men by means of the tungsten lamp, especially by the series-incandescent system of lighting, which is popular in New England. The tungsten lamp, he said, deteriorated only from five to ten per cent, while the gas mantle deteriorated thirty to forty per cent for the first hundred hours, and up to seventy per cent for longer periods.

C. A. Howe, manager of the Chicago office of the Holophane Company, said that the tungsten lamp at first occasioned fear among central-station men, but it was now recognized that the new lamp has done more than anything else to raise the standard of illumination.

Mr. Merrill, answering a question by R. C. Waite, saw no objection in the use of the lamp for residences, although some thought that the yellowish light of the carbon lamp was more homelike.

Mr. Perry advocated the tungsten for house lighting, except in some minor features, as small candelabra, etc.

J. H. Harding, of Laporte, Ind., said that the principal trouble was the bad practice of trying to utilize unsuitable existing fixtures for tungsten lamps.

Mr. Howe said the tungsten gave a more pleasing light than the gas mantle, and, if properly installed, should be the chief weapon to enter the home with electric service.

G. E. Varney, of Danville, Ind., said that the ordinary tungsten units are too large for the average residence. He suggested a twenty-seven-volt size and the use of transformers, so as to use small and numerous units to give enough light, but without the glare of the larger lamps.

Mr. Howe said that proper installation covers proper sizes of lamps. Many indirect methods of lighting, as the I-Comfort system, had successfully tackled this problem with regard to the proper installation of fixtures, the placing of lamps, etc. A study of these will enable the tungsten lamp successfully to enter the home-lighting field.

Mr. Harding remarked that the trouble was with old, not new, installations.

Mr. Howe said that sometimes old fixtures can be changed, but that chiefly it is a question of new fixtures.

Mr. Osborne recommended the use of

frosted tips, suitable shades, etc., to soften the glaring effect.

At the commencement of the Thursday morning session, at 10 a. m., the president announced that this session would be prolonged to complete the whole of the proceedings in order to permit of the members catching an early train.

CENTRAL-STATION HEATING.

A paper entitled "Central-Station Heating," by W. H. Schott, of Chicago, was read in the author's absence by Mr. Hornung.

Success in central-station heating was due to the general conditions surrounding the plant being favorable and to the existence of a heating situation, as well as, of course, suitable design and the cognizance taken of the commercial requirements. The type of plant depends on the conditions of the territory to be covered. As a rule, with numerous large buildings close together, a steam plant is required; for other situations water is the more economical. The different points to be regarded in making installations were given at length. Plants using coal and those employing exhaust steam both paid, if properly founded. Curves were exhibited showing what some of the heating plants are doing when operated with electric-lighting plants in the state of Indiana. The author showed that a heating plant properly operated in conjunction with a lighting plant will earn sufficient money to absorb the fuel charges of the combination plant and leave a profit, besides the aid they gave in taking care of competition.

A vote of thanks was accorded the author and reader of this paper. There was no discussion.

NEW BUSINESS AND ADVERTISING.

A paper on "New Business and Advertising" was read by A. P. Tills, of the Evansville Gas and Electric Light Company, Evansville, Ind.

One sure way to increase business is to put out men to take care of old customers and to solicit new business. The average business man likes to be interviewed by central-station representatives rather than to have to seek the company. It is good policy to keep men in the field, and when funds are low these men can be paid on a commission basis, to which any good solicitor will not object. Peak business is similar to order business and can be transacted by mail if necessary, but for off-peak business the solicitor is an indispensability. The best method to get new business is to go out and get it. Electric companies may co-operate with gas companies where heating is required to get business, but not otherwise. Local newspaper advertising gives slight returns compared with solicitors, and such expenditure is usually a matter of policy in keeping in with the papers. The advertising quality of light should be insisted upon to local merchants, in prospecting for new business. Another point of value in this respect is to advertise the good results due to the advertising qualities of light installations already furnished in the town, which stirs up a spirit of competition among those merchants who do not want to be thought backward in adopting modern methods. Circulars are no good unless followed up by solicitors.

The discussion resolved itself mainly into a spirited debate between C. C. Perry and G. E. Varney.

Mr. Perry related how his advertising campaign in Indianapolis had increased business and told of the good effects of the "electric house" he had had fitted up in the fourth story of his company's building, which had a good educative effect on the public in showing them the possibilities and utilities of electric light and appliances.

Mr. Varney discussed the feasibility of co-operation between central stations and the dealers. The latter, he said, were incensed at the action of some of the central-station companies because of their cutting prices on electric appliances to secure their adoption in order to sell more current. The dealers can't do this, for their profit comes from the sales of the appliances, and not of the current. The central stations, by antagonizing the dealers, were losing a valuable adjunct for securing new business.

Mr. Perry agreed with this point of view, but remarked that the central stations spent a deal of money in seeking new customers; his own company had spent between $2,000 and $3,000 in two or three months recently in this way. The dealers don't or won't do this as a rule. He sells lamps at cost, but would rather the dealers would handle this business, if they would push it sufficiently; but would they, he asked?

Mr. Varney commended this argument, but asked if it were not possible to obtain active co-operation with the dealer, who has not the facilities the central stations have of reaching prospective customers. The very fact of spending $2,000 or so demands a profit for selling utensils to cover this outlay. By making a price comparable with the lowest profitable price of the dealer, the central station could at least obtain his good will.

Mr. Perry told of the situation at Indianapolis, where three different central-station companies were competing, and such things happened as giving utensils away gratis, which was deplorable from a business standpoint.

Mr. Howe remarked that it all settled down to a matter of education—some of the central-station companies had educated the public to expect something for nothing. He told of a St. Louis man who acted differently. This man always obtained list prices, and the dealers were thereby encouraged to co-operate with him.

This ended the discussion, following which Mr. Howe gave, by the aid of figures on a blackboard, a demonstration of the practical application in illumination problems of the flux-of-light method of Cravath and Lansing.

IMPROVING THE LOAD FACTOR.

H. W. Eells, of the J. G. White Company, New York, then read a paper entitled "How Can We Best Improve Our Load Factor?"

In considering the influences affecting the load factor the author divided these into two parts: (1) Fixed charges. (2) The quantity of output, which is dependent on fuel, oil, water and other charges, and wages. Wages do not increase materially, if at all, with the output, neither do the fuel and water charges. Depreciation of boilers is about the same, whether they are idle or running at maximum capacity. Maintenance of the distribution system is likewise unaffected by changes of load. The obvious inference, then, is to operate a system already designed and installed, to its fullest extent. The author recommended every solicitor to possess a copy of the Electrical Solicitor's Handbook, recently published by the National Electric Light Association. Solicitors should show customers how to reduce their bills and obtain the most satisfactory service. The question of rates was discussed briefly and the utility of storage batteries in certain cases. A continuous campaign the author considered was a straight business proposition and one satisfied customer was better than ten prospectives. The company's offices should be central and attractive, and the officials should be readily accessible for personal interviews. A display room is advisable. Second orders are easier to obtain than first orders, and each kilowatt used is equivalent to a new sale. Publicity and generous advertising are profitable. Lists of customers should be classified, also the types of plant that can be used by them. Old customers are prospects for all they do not already use. Small cities should give a larger per capita return than large cities. It was policy to persuade customers to discard steam or other non-electric power and put in motors, and arrange to pay for these by installments. The author suggested the formation of an association to obtain the highest possible price for the old plant. This, he intimated, might be done under the auspices of the state electrical association. Customers should be advised freely in regard to new installations, and in selling light other devices should be pushed to better the load factor. Secondary distribution systems should be extended from transformers and adapted for the use of electric appliances as well as light installations. In conclusion the author referred briefly to the use of the tungsten lamp and pointed out that if by its use light bills were reduced its influence was greatly beneficial on the load factor by enabling customers, who were usually prepared to spend the same amount as formerly on electric current, to install electrical devices which were mainly used in off-peak hours.

L. E. Holderman, assistant general manager of the Terre Haute, Indianapolis and Eastern Traction Company, Terre Haute, Ind., told of the policy of his company in allowing dealers bonuses for new business, as follows: Fifty cents per customer plus five cents for each sixteen-candlepower unit sold; fifty cents for twelve-inch fans, seventy-five cents for sixteen-inch fans; flatirons, forty

cents and fifty cents, according to capacity. Lamps were sold to dealers at two cents less than general prices, and motors at from seven-and-one-half to ten per cent off the retail selling price. By these means co-operation was effected with the dealers and confliction avoided.

R. W. Waite upheld Mr. Varney's arguments put forth in a previous discussion and said that a reasonable profit of from twenty to twenty-five per cent should be made on electric appliances. He was doing this, successfully.

In reply to a query by Mr. Leslie, Mr. Eells said that a load factor of forty per cent (up to fifty per cent in rare cases) was usually obtainable in average plants, defining the load factor as the ratio average load to peak load.

A unanimous vote of thanks was accorded to Mr. Eells for his paper.

A congratulatory telegram was dispatched at this time to the Michigan Electric Light Association, which was holding its annual convention at Detroit.

LIGHTNING ARRESTERS.

E. E. F. Creighton, of the General Electric Company, Schenectady, N. Y., gave a practical demonstration on lightning arresters.

He showed that lightning arresters have to take care of frequencies of from 2,000,000 cycles per second of actual flashes, down to the sixty cycles or so of the generators. The multigap arrester is no good for a continued succession of discharges. The new aluminum electrolytic arrester remedies this defect and is easily good for ten years on a ten per cent depreciation allowance. The chief disadvantage of the aluminum arrester is the necessity for continuous inspection, and this will limit its use on distribution circuits on account of the cost both of installation and inspection.

Mr. Creighton continued his interesting lecture at 2:30 p. m. to those members who were not leaving on the early train.

At this point the president gave a brief address, in which he deprecated the absence of many of the active members and cordially thanked the supply men for their earnest co-operation in making the meeting a success.

ELECTION OF OFFICERS.

The secretary then proceeded to read the report of the nominating committee, which was adopted unanimously. The following officers for 1909-1910 were elected:

President, C. C. Perry, Indianapolis Light and Heat Company, Indianapolis, Ind.

Vice-president, G. E. Varney, Danville Light, Heat and Power Company, Danville, Ind.

Secretary-treasurer, Fred Leslie (re-elected), Muncie Electric Light Company, Muncie, Ind.

Executive Committee, J. H. Harding (chairman), Laporte Electric Company, Laporte, Ind.; L. E. Holderman, Terre Haute, Ind.; W. B. McDonald, Evansville, Ind.; J. P. Ohmer, Elkhart, Ind.; R. W. Waite, New Albany, Ind.

The new president was then introduced and gave a brief address in which he forecasted a brilliant future for the Indiana Electric Light Association. At his suggestion a vote of thanks was accorded with acclamation to the retiring president and to the secretary-treasurer for their earnest work during the past year.

Among the supply men and manufacturers' representatives present were the following: H. H. Cudmore, Brilliant Electric Company, Cleveland, Ohio; Harry C. Rice, General Incandescent Lamp Company, Cleveland, Ohio; J. E. Hall, Fort Wayne Electric Works, Fort Wayne, Ind.; G. S. Merrill, National Electric Lamp Association, Cleveland, Ohio; E. E. F. Creighton, General Electric Company, Schenectady, N. Y.; A. L. Waddle, Varney Electric Supply Company, Indianapolis; Mr. Townsend, F. Bissell Company, Toledo, Ohio; H. C. Houck, General Electric Company, Cincinnati, Ohio; R. C. Sueve, Allis-Chalmers Company, Cincinnati, Ohio; George C. Osborne, General Electric Company, Harrison, N. J.; J. W. Kampman, Illinois Electric Company, Chicago, Ill.; J. C. Henderson, Westinghouse Electric and Manufacturing Company, Indianapolis, Ind.; W. H. Pearl, Central Electric Company, Chicago, Ill.; F. O. Kirkpatrick, Westinghouse Electric and Manufacturing Company, Cincinnati, Ohio; A. S. Phill, Poyse Electric Company, Indianapolis, Ind.; A. D. Gillespie, Monarch Electric and Wire Company, Chicago, Ill.; P. R. Boole, Electric Appliance Company, Chicago, Ill.; H. W. Strock, Shelby Electric Company, Shelby, Ohio; J. H. Dunbar, O. Canman, P. Worth and J. R. Farrell, General Electric Company, Cincinnati, Ohio; C. A. Howe, Holophane Company, Chicago; A. B. Hoffman, Wagner Electric Manufacturing Company, Cincinnati, Ohio; Thos. H. Gage, Monarch Electric Company, Chicago; A. M. King, Brilliant Electric Company, Cleveland, Ohio; J. H. Bell, Electric Appliance Company, Cleveland, Ohio; J. F. Kerlin, National Carbon Company, Cleveland, Ohio.

FRED. LESLIE,
Secretary Indiana Electric Light Association.

The above list is only partially complete, owing to the lateness of some of the registrations and the unexpectedly quick close of the proceedings.

There was no exhibition in connection with the convention, but the Shelby Electric Company, of Shelby, Ohio, and the Holophane Company had a joint showroom in the hotel. The former company was represented by Henry W. Strock and showed carbon, tungsten and other lamps. W. H. Myers, sales manager of the Shelby company, arrived on Thursday from Detroit, where he had been attending the Michigan Electric Association's convention, in time to interview many of the delegates. The Holophane Company was represented by Charles A. Howe, manager of the Chicago office of the company, who was present with a very handsome display of Holophane globes and reflectors. Both exhibits attracted much attention and Mr. Howe was constantly surrounded by an attentive audience, to whom he gave many practical pointers on the subject of artistic and economical illumination.

The Right Kind of Bump.

Milan R. Bump, native of Spokane, Wash., has been placed in entire charge of the construction of the $2,000,000 electric generating plant to be constructed on Spring River, near Joplin, Mo.

The plant is being constructed by Henry L. Doherty & Company, of New York, which company recently purchased the Spokane gas plant.

The young engineer, who has been entrusted with the entire charge of the construction work on the mammoth plant, is well known in Spokane, having graduated from the local high school with the class of 1898. Mr. Bump was then but seventeen years old. Four years later he graduated with the class of electrical and mechanical engineers from the University of Wisconsin at Madison. For about fifteen months he was in the employ of the Washington Water Company, and since leaving Spokane six years ago has been with the New York company.

It is stated that $6,000,000 will be ultimately expended on the plant.

Navy Department Supplies.

Bids will be opened on September 7 for one surface condenser, for delivery at Charleston, S. C.; one indicator, for delivery at Brooklyn, N. Y.; and one punching and shearing machine, for delivery at Washington, D. C.

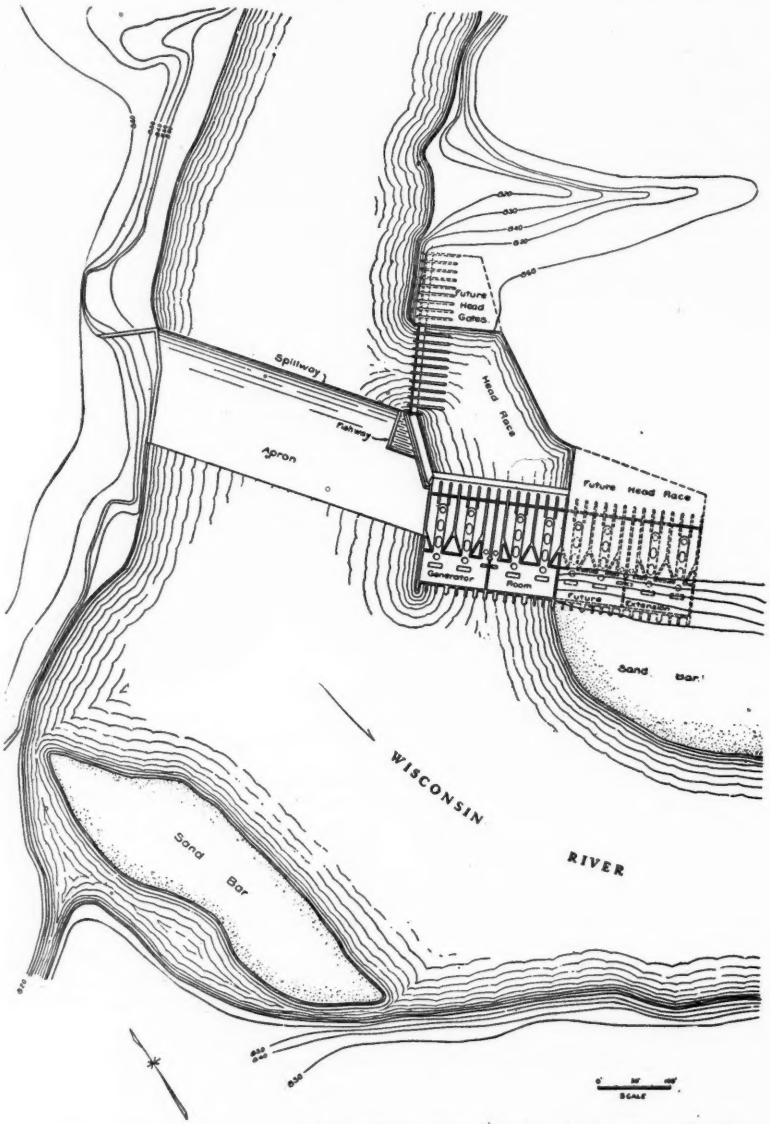
The Kilbourn Hydroelectric Plant.

The village of Kilbourn, Wis., has long been noted as being the center of the famous Dells of the Wisconsin River. For many miles along the river at this point the water has steadily eroded its way through a sandstone bed, leaving its valley marked by the most varied and picturesque stratified rock formations, in cliffs, ravines, canyons, gulches and caves, to be found in this portion of the country. These interesting sights, combined with excellent boating and fishing, have made the Dells quite a summer resort. To these attractions around Kilbourn there has just been added one of the largest dams and hydroelectric power developments in the state of Wisconsin. This is the plant and transmission system of the Southern Wisconsin Power Company, which it will be the aim of this article to describe.

An exhaustive study of the characteristics of the Wisconsin River and of the waterpower project in general was made by the company's consulting engineer, Prof. D. W. Mead, of Madison, Wis. Some of the main hydraulic data collected in this investigation have been published in his latest book.[1] About one-fourth of a mile below the double-deck railway and highway bridge at Kilbourn was found an excellent site for the construction of a dam across the river, which would give a normal head of seventeen feet. By means of this dam the river could be controlled so as to give a minimum flow of about 5,000 cubic feet per second.

The construction of the dam involved the formation of a reservoir some ten miles long by the raising of the river level above the dam about fifteen feet, which, it was feared by the residents, would destroy the beauty of the upper Dells. To avoid litigation, the backers of the project formed a subsidiary corporation, the Wisconsin Dells Company, which purchased the land that was partly flooded, including the principal scenic spots. On completion of the dam this summer it was found that the beauty of the Dells was not materially marred; on the contrary, by increasing the depth of the stream, larger boats and launches could be used than heretofore, and a much greater portion of the river could be easily reached, thus disclosing a number of points of geological and scenic interest that had formerly been practically inaccessible.

In the accompanying plat the general layout of the Kilbourn plant is clearly shown. The power house is located on the eastern shore of the river at a bend in the stream. Its site had to be cleared largely by blasting out the solid rock. At present four main generating units have been installed that have a normal capacity of 8,000 horsepower. A future extension of the plant to double its present capacity is contemplated. This is shown by the dotted lines.



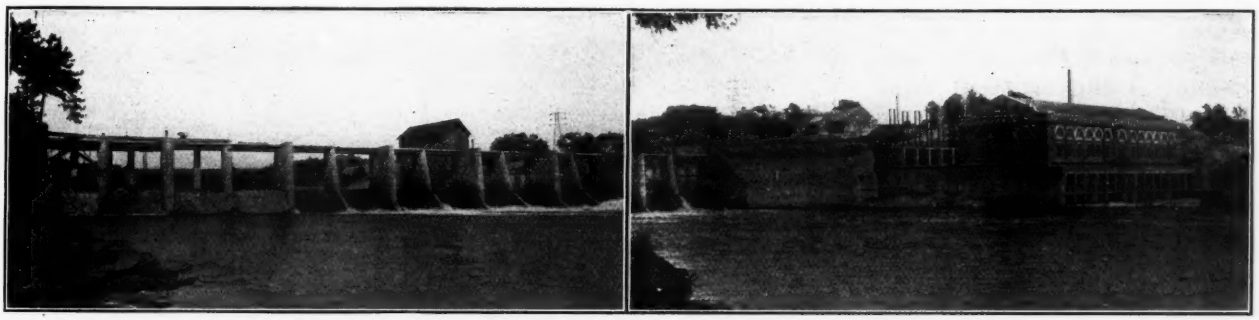
From "Water Power Engineering," by D. W. Mead.
GENERAL PLAT OF THE HYDROELECTRIC PLANT, KILBOURN, WIS.

THE DAM.

The dam has a total length of 340 feet across the river, and an extreme width, including the apron, of 154 feet. Its crest has a width of about fifteen feet and is normally seventeen feet above low water. On account of the severe floods to which this river is occasionally subject it was necessary to arrange a movable crest to permit a possible flood flow sixteen feet deep to pass over the dam. For this purpose twelve gates, each twenty-five feet wide, are provided between concrete piers, thus giving a total spillway of 300 feet. The gates are of steel and weigh about seven tons each. They are capable of being lowered six feet into the dam. For moving them, a continuous line shaft has been erected along the footway on top of the dam; any gate may be raised or lowered by connecting it to this shaft through a clutch and gear.

[1] "Water Power Engineering." By Daniel W. Mead. McGraw Publishing Company, New York, 1908.

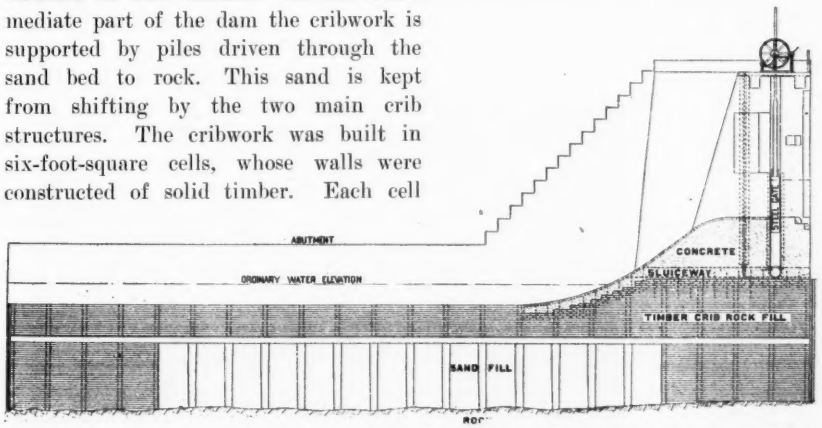
For driving the shaft a fifteen-horsepower, 220-volt induction motor and its controller are installed in the little brick control house at the southeastern end of the dam. The gates may also be operated by hand. To prevent the pockets for the gates from getting clogged up, sluiceways have been provided through the bottoms of the pockets. By raising the wooden gate in each a strong flow of water is established therethrough, thus washing out any accumulation of sand or other sediment. At the southeastern end of the dam a fishway has been constructed.



The H. H. Bennett Studio, Kilbourn, Wis.

DOWN-STREAM VIEWS OF THE DAM AND POWER HOUSE AT KILBOURN.

The construction of the dam is shown by the accompanying cross-section and general views. The apron of the dam extends about 100 feet beyond its main body. The ends and face of the dam itself have a foundation of rock-filled timber cribwork resting upon the solid rock. The edge of the apron is also constructed in this manner. In the intermediate part of the dam the cribwork is supported by piles driven through the sand bed to rock. This sand is kept from shifting by the two main crib structures. The cribwork was built in six-foot-square cells, whose walls were constructed of solid timber. Each cell was then carefully filled with rock and sand. The top of the dam and its piers are of reinforced concrete, which is tied to the cribwork foundation. All the timber work is constantly submerged in water, and only the concrete portion is exposed.



From "Water Power Engineering," by D. W. Mead.

CROSS-SECTION OF THE DAM AT KILBOURN.

To render the dam impervious, triple sheet piling has been placed along the face of the dam and the toe of the apron. This has been securely bolted to the cribwork and prevents leakage of water through or below the dam. As a further protection for the stability of the structure, riprap has been placed both above and below the dam itself. The utmost care was exercised throughout the design and construction of the dam, and over two years were required for its erection.

POWER HOUSE.

The power house proper is about 200 by sixty feet in dimensions. A good idea of its arrangement can be obtained from the illustrations herewith. The generator room (190 by thirty-four feet) constitutes the main portion of the building itself. It is unobstructed from the generator floor to the roof. Surrounding it entirely is a gallery at the switchboard and transformer level, twenty feet above the floor. The penstocks, in which the hydraulic turbines are entirely submerged, extend under the switchboard floor and under the platform between the power-house building and the gates in the head race.

There are at present eleven entrance channels between concrete piers between the river and the head race. For the future extension nine others will be provided. The head race is excavated from solid rock and is unlined. The water passes through racks to intercept floating objects before passing through the head gates and wheel pits. There are fourteen head gates, three for each main unit and one for each of the two exciter units. These gates are operated by a three-phase induction-motor-driven crab hoist that can be moved opposite any gate along the track on the top of the wall. A wire conduit, with specially protected outlet boxes, is embedded in the concrete along the top of the wall. The terminal of a flexible cable from the motor can be plugged in at any of these outlets. The head gates may also be operated by hand.

Each turbine unit consists of three pairs of turbine wheels, fifty-seven inches in diameter, built by the Wellman-Seaver-Morgan Company, of Cleveland. Each wheel is rated at 500 horsepower maximum. All the six wheels are direct-connected in tandem to the generator shaft. The four middle wheels discharge in pairs through common draft tubes; the two end wheels have independent draft tubes. The bearings within the wheel pits are reached by separate manholes with wrought-iron casings, as shown in the cross-sectional view. The total length of each main turbine is seventy-four feet. For each of the exciter units only two wheels constitute the turbine equipment. The turbines are all controlled by Lombard governors, built by the Lombard Governor Company, of Ashland, Mass.

Between the wheel pits are triangular rooms entered from the generating room. In these are stored oil, waste, and other supplies, and in two of them are installed motor-driven pumps for supplying cooling water for the transformers and for the power-house service in general. In another of these rooms is installed a set of three fifty-kilowatt step-down transformers for the power-house motor and lighting service.

The main generators are of the re-

volving-field type, and are rated at 1,500 kilowatts at ninety per cent power-factor. They generate twenty-five-cycle current at 2,300 volts, and have a normal speed of 100 revolutions per minute. The exciter units are rated at 150 kilowatts each and develop 125 volts when running at 200 revolutions per minute. They are compounded for constant voltage. The connections from the generators and exciters to the respective busbars are made by varnished cambric insulated cables passing through the concrete floor and wall to the switchboard level. From this point on the three leads for each generator are carried together in five-inch iron pipe conduit to the busbar and oil-switch floor directly over the switchboard.

SWITCHBOARD.

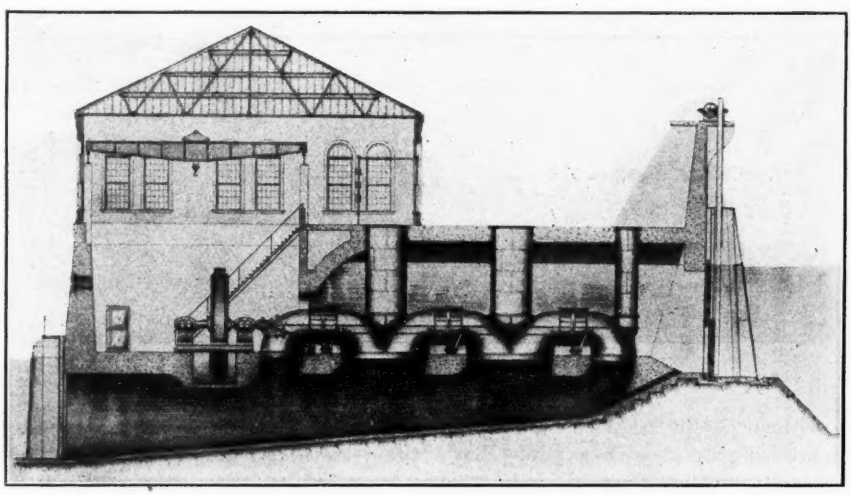
The main switchboard is of blue Vermont marble and is located along the northeastern portion of the gallery. Its equipment is very complete and provides indicating and recording instruments for each of the generator and outgoing line circuits, as well as a comprehensive outfit of regulating and switching devices. All switching operations on the 2,300-volt and high-tension circuits are remote-controlled, solenoid-operated oil swittches being used. All alternating-current circuits are twenty-five-cycle, three-phase. A separate switchboard is provided for the low-tension power and lighting circuits for station service.

joint or independent control of the exciters in connection with a Tirrill regulator. This is arranged so as to compensate for either or both sets of the 2,300-volt generator buses. The 125-volt, direct-current control circuits for operating the oil switches, and the station-lighting circuits, may be connected at this panel to either exciter bus.

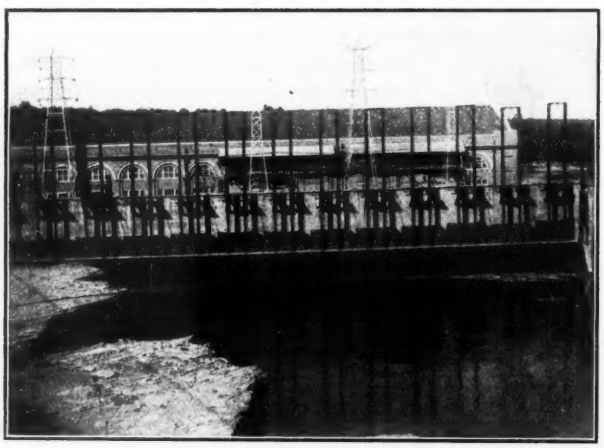
Next are the four main generator panels, which are each provided with a field ammeter and field switches connected to either exciter bus. The other instruments on each of these panels are: An indicating wattmeter, an integrating watt-hour meter, a voltmeter for connecting across each machine phase, and an ammeter with switch for connecting into each phase. There are also plug controls for the oil switches connecting the generator to either the A or B set of 2,300-volt buses. Each of these controls is provided with red and green pilot lamps, as has become standard. On each of these panels there is also a plug control for the motor on the turbine governor that can change the speed of the unit. In adjusting the speed during synchronizing, this plug when pulled starts this motor one way, and when pushed starts it the other way.

Four panels are reserved for the generators to be added in the extension of the plant. At the left end of the board are hinged a synchroscope, a bus voltmeter, and a frequency indicator. These instruments can be plugged in on either set of buses from any generator panel.

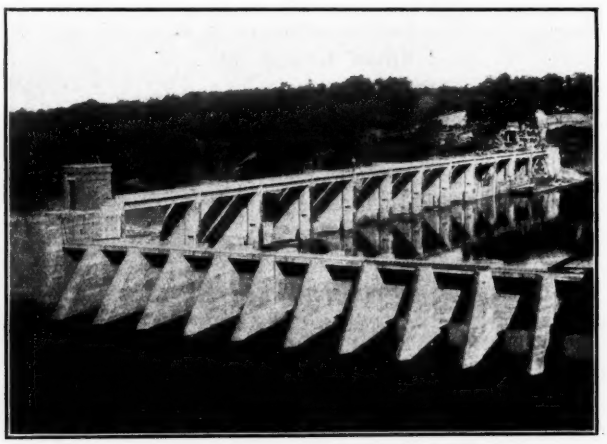
There are at present two main transmission lines operating temporarily at 44,000 volts. There are separate panels for the bank of three step-up transformers associated with each line. Each of these panels has an integrating watt-hour meter, an ammeter for each phase, and a power-factor indicator; plug controls with pilot lamps for the oil switches connecting each bank of transformers to either set of 2,300-volt buses; and inverse-time-limit relays for each of these



From "Water Power Engineering," by D. W. Mead.
CROSS-SECTION THROUGH POWER HOUSE.



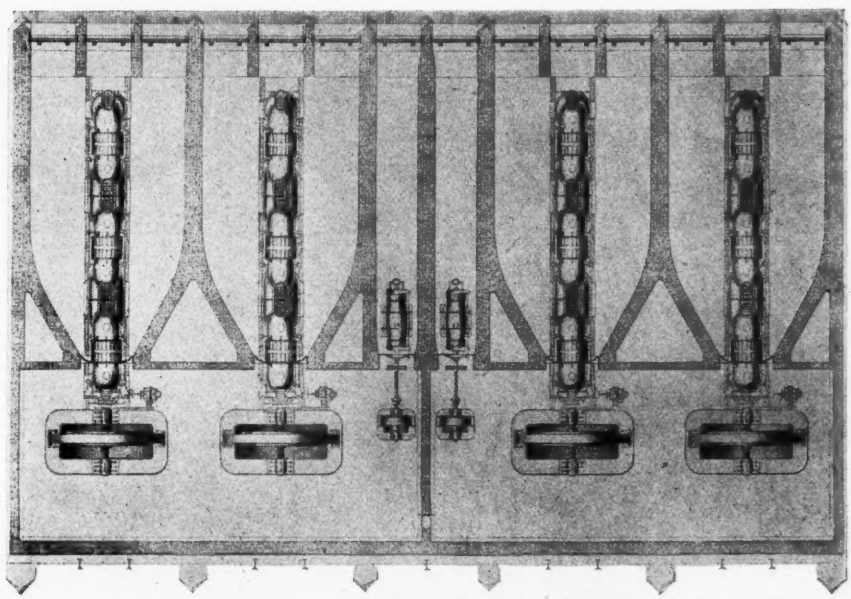
Head Gates and Terminal Towers.



The Dam. Entrances to Head Race in Foreground.
UP-STREAM VIEWS OF POWER HOUSE AND DAM.

At the left end, when standing in front of the main board, are two exciter panels, each having a voltmeter, ammeter and circuit-breaker of suitable range. Two sets of exciter buses are provided, to either of which each exciter may be connected. This enables them to be operated independently or in parallel. Adjoining these panels are two other panels for the

switches. Next to these panels is one with a curve-drawing voltmeter that can be connected to either the A or B bus. Adjoining it are two panels for each of the outgoing, high-tension lines. There is on each of them a curve-drawing wattmeter and the control for the line switch. On one panel there is a similar control for the tie switch, by means of which the two lines may be operated in parallel. Provision is being made for two 2,300-volt feeders to supply the Kilbourn city lighting plant and power users. The panels for these lines are provided with ammeters, indicating wattmeters, integrating watt-hour meters, and the requisite plug controls and pilot lamps for switching each line on to either the A or B sets of busbars.



From "Water Power Engineering," by D. W. Mead.

PLAN SHOWING WHEEL PITS, TURBINES, GENERATORS AND EXCITERS.

The last panel on the board contains similar instruments and switch equipments for the bank of three fifty-kilowatt 2,300/220-volt station transformers. The low-tension side of these transformers connects to the separate station switchboard, which will be described below.

In the control equipment for the oil switches provision is made so that no machine or transformer can be put on the bus except through the six-point plug. The control wiring for all the switches is run in conduit and is sectionalized by fuses so as to permit ready location of trouble. Near the middle of the switchboard is a telephone panel, by means of which the operator can communicate with anyone about the plant.

The arrangement of the 2,300-volt buses which, with oil switches associated therewith, are located on the floor above the switchboard, is shown by the accompanying view. These buses are sectionalized so that at one side are the transformer and generator switches, and at the other the switches for the local and station circuits. The buses can be tied together through any generator or other oil switches connected with them. The switches for the 2,300-volt circuits from the generator and the local and station transformer lines, are of the K-2, solenoid-controlled, oil-switch type. They are rated at 500 amperes and 7,500 volts. The main transformer switches are of the same type, but are capable of carrying 1,500 amperes each. All of these oil switches are of the triple-pole pattern.

Before describing the station equipment for the high-tension transmission lines, it will be well to consider the separate switchboard for the station circuits. This is located in a room to be partitioned off at the east end of the gallery floor back of the main switchboard. This room is fitted up as a machine shop for general repairs and new construction work. In this shop there is an equipment of several machine tools that are driven by individual direct-current motors, either from the exciter bus or from a Northern Electric Company motor-generator set of fifteen kilowatts, changing the 220-volt alternating current to 125-volt direct current. The generator of this set was run by a Westinghouse steam engine during the construction period, thus providing a supply of current for the operation of these tools.

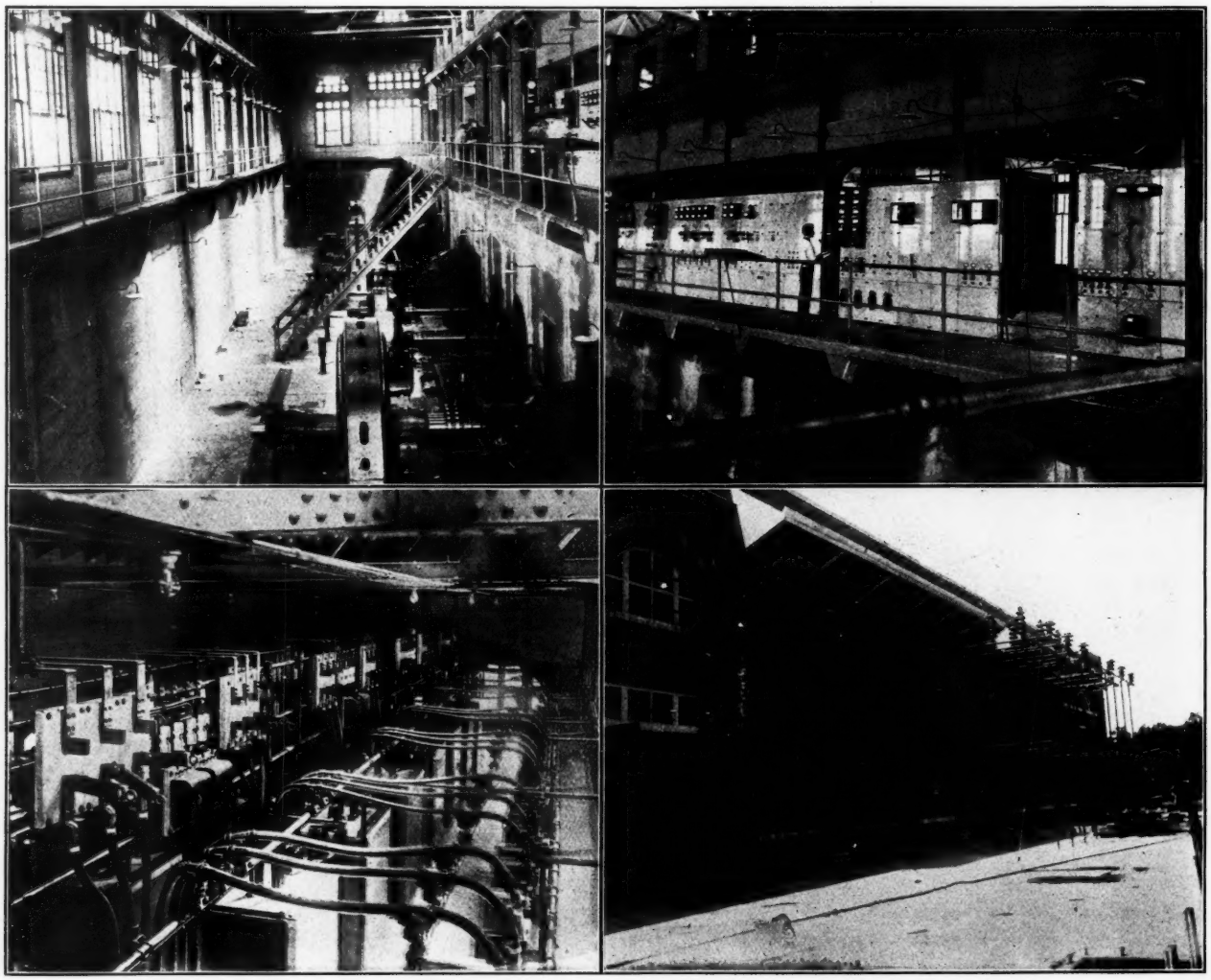
The station switchboard controls the circuits for lighting and motor service throughout the plant. These circuits are intended to be run normally from the step-down station transformers referred to above. The lighting circuits can be connected on the three-wire system to the 220-volt secondaries of these transformers, or on the two-wire system to the exciter circuits. Among the motors controlled from this board are the motor of the motor-generator set referred to, the motor-driven sump pumps in pits No. 1 and No. 2, the motors for the dam gates, head gates and tail gates, and other motor-driven pumps for house service. Provision will also be made for a motor to drive the twenty-ton Northern Engineering Works traveling crane which spans the generator room; at present this crane is operated by hand.

The station board and these various motors were furnished by the Fort Wayne Electric Works. Practically all the other electrical apparatus, including the generators, exciters, oil switches, transformers and lightning arresters, the main switchboard with nearly all its switches and instruments, except some Weston direct-current instruments, were supplied by the General Electric Company.

The step-up transformers for the high-tension lines are installed in separate compartments on the switchboard floor to the north of the main board. There are six 1,100-kilowatt oil-filled, water-cooled transformers, each line having a bank of three. Each transformer may be isolated by disconnecting switches in both the high-tension and low-tension lines, and is mounted on wheels so as to be capable of being rolled out of its chamber to the edge of the gallery, where it may be picked up by the traveling crane. The risers for the pipes supplying the circulating water are erected along the wall of the north gallery. The discharge pipes have gaps above funnels, so that the amount of flow can readily be seen from the switchboard and its temperature easily determined.

The transformer connections are now delta, thus stepping up from 2,300 to 44,000 volts. By connecting the secondaries in Y they will step up to about 72,000 volts. This will be done when the receiving circuits at the end of the transmission line are prepared to receive 66,000 volts. Each of the high-tension leads leaving the transformers, after passing through a disconnecting switch, divides into two branches, one running to the outgoing line and the other

through a disconnecting switch to a tie oil switch. This is installed between the transformer banks. The other branch to the line passes through a disconnecting switch, a similar line oil switch, and through the series relays, ammeters, and choke coils to the wall insulators and out to the tower line. These tie and line switches are of the K-10, triple-unit, joint solenoid-control pattern. They are each of the three other cells. This ground cell is mounted so it can be interchanged with one of the three line cells. To charge these electrolytic cell arresters once a day, one side of each horn gap is pivoted on a vertical axis so it can be brought into contact with the opposite horn, which is normally locked in a slightly offset position. Concrete hoods have been built over the wall of concrete. The barriers between the different phases are either of concrete or slate. The high-tension bus chambers on the upper floor have asbestos-board doors. Rooms containing high-tension apparatus are kept locked. All the high-tension wiring within the building is of three-fourths-inch copper tubing, angles and tees being slipped into the ends of the straight lengths and soldered thereto;



Generator Room.
2,300-Volt Oil Switches and Busbars.

Main Switchboard.
Lines Leaving Building and Horn Gaps.

THE KILBOURN HYDROELECTRIC POWER HOUSE.

designed for 100,000 volts and 100 amperes.

A tap is taken off from the line at the last tower and passes through a horn-gap set that is mounted on a pipe framework on the platform over the wheel pits just outside the building. The ground side of the horn gaps is connected through wall insulators to a set of aluminum-cell lightning arresters mounted near the wall inside of the building. There are four of these cells for each line, one in each of the three line connections, and one between ground and the ground side of insulators where the lines and lightning-arrester circuits pass through the station wall.

Two No. 0 copper ground wires are run in concrete the entire length of the building, and are submerged in the running water at several places. To these are securely grounded the legs of the terminal towers, all inspection tubes, the grounds from the lightning arresters, and all other connections that require grounding.

All the bus compartments for the 2,300-volt and high-tension circuits are built this makes a very stiff construction. All the copper used for the 2,300-volt and low-tension busbars was cut and bent on the ground.

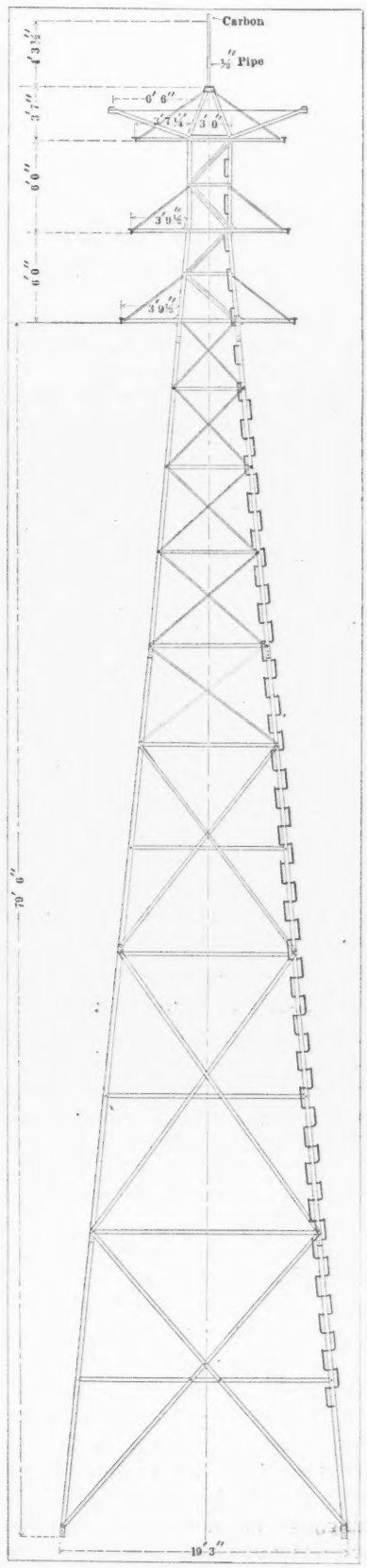
On the bottom chord of the roof trusses a plank runway has been placed. It runs the entire length of the building and is accessible from either end. This runway commands an entire view of the station. On one side can be seen the generating room and on the other the busbars, oil switches and other auxiliary high-tension apparatus. Thus in case of serious trouble the extent of the disturbance can

be readily observed without great personal hazard.

TRANSMISSION LINES.

The Southern Wisconsin Power Company is singularly fortunate in that it has a consumer for its power that takes about half of its output, and is ready to take all of the energy that is generated at the plant. This consumer is the Milwaukee Electric Railway and Light Company. A steel tower line has been erected by the power-producing company from Kilbourn to Watertown, Wis., a distance of nearly seventy miles. At the latter point the current is delivered to the Milwaukee company, which has an interurban railway line terminating at Watertown. The tower line has been continued east of Watertown for fifty miles by the Milwaukee company, and terminates at the West Allis substation, where the current is stepped down to 13,200 volts and transmitted underground five miles to Milwaukee. The total length of the transmission line thus is 120 miles from Kilbourn to Milwaukee. At the present time power is being transmitted over this entire distance at a potential of 44,000 volts at the power plant. A substation is to be erected at Watertown which will be equipped to receive 66,000 volts in the near future. That portion of the line from Milwaukee to near Watertown was built several years ago to carry a maximum of only 44,000 volts, and the substations between these points are also equipped for this potential. As soon as this substation equipment has been changed for the higher voltage, the potential will be raised to 66,000 volts at the Watertown receiving end.

The line that was erected by the power company was built almost entirely on private right-of-way. From Kilbourn to Watertown it follows very closely the main line of the Chicago, Milwaukee & St. Paul Railway. The construction of the steel towers is clearly shown in the accompanying views and in the elevation of the structural part of the highest tower. The entire tower is built of galvanized steel and is of the four-post pattern. For carrying the line wires, which are suspended from triple-unit suspension-type Thomas insulators, furnished by the H. W. Johns-Manville Company, three brackets are provided on each side of the tower. These are well braced and are mounted one over the other. On top of the tower a pair of upwardly extending brackets is provided for carrying ground wires almost directly over the transmission lines. These ground wires are placed thirteen feet apart. At the apex of the tower a lightning rod extends upward about four feet and is capped by a carbon point.



ELEVATION OF STEEL TOWER.

The two transmission lines are arranged to be operated independently or in parallel. Either one alone will suffice to carry the total energy when repairs are being made on the other line. The transmission cables are No. 0 six-strand copper wire with a hemp center. For the ground wire a seven-strand galvanized-iron wire has been used for ten miles from the power house and for four miles at the receiving end. It was thought desirable to study its efficacy in protecting the line before extending its use over the entire distance. Brackets for carrying the ground wire are provided on each tower, however, so that it can be placed along the entire length of the line, if desired.

The average height of the towers is forty feet. The highest one is eighty feet. The average space between towers is 525 feet. At railroad crossings and at curves the spacing is considerably less. At all deviations in the direction of the line from ten degrees to twenty degrees strain insulators are used for supporting the outer transmission cables. At angles in excess of this point the strain insulators are used on both the inner and outer lines. The total number of towers erected by the power company for its portion of the transmission line was 720.

The contract between the Southern Wisconsin Power Company and Milwaukee Electric Railway and Light Company runs for a period of twenty-five years, during which the latter company agrees to take an average of 84,000 kilowatt-hours per day. A number of requests have been received for the sale of power to communities near Kilbourn, particularly along the present tower line. Arrangements are being made to supply the city of Portage. The circuits for the local Kilbourn installation have already been provided, but the pole line has not yet been completed. These circuits were used after the plant began running on June 8 of this year for testing out the generators and the rest of the equipment. The first commercial load transmitted over the tower line to Milwaukee was supplied on the second of this month.

For the data that were used in preparing this article the author is indebted to H. P. Broughton and H. P. Ridgely, general manager and superintendent, respectively, of the Southern Wisconsin Power Company, and to Daniel W. Mead, its chief engineer.

Telephone and Telegraph Business.

The capital invested in the telegraph and telephone business in this country is in excess of a billion, $814,616,004 credited to the telephone systems and $220,293,575 to the telegraphs. According to the third census of the electrical industries, made by the government, there is a grand total of 15,072,220 miles of single wire in the telegraph and telephone service. Of this, the telephone systems controlled 12,999,369 miles, of which there were on pole or roof lines 5,002,223, in overhead cables 2,917,114, in subways or conduits 9,469,302, and in submarine cables 20,730 miles. Of the grand total stated, the telegraph systems, exclusive of government telegraph systems, used 2,072,851 miles, of which there were on pole or roof lines 1,958,336 miles, in overhead cables 41,886, in subways or conduits 65,347, and in submarine cables 7,382 miles. These figures emphasize the economic importance of the telegraph and the telephone.

A comparative summary deals with the telephone and commercial telegraph systems, not including railroad lines and the wireless, giving the grand total as 22,996 companies, of which there are 22,971 telephone systems, which include 17,702 independent farmer or rural lines and twenty-five commercial telegraph systems, not including the wireless. The grand total of single-wire mileage was 14,570,142, of which the telephone systems controlled 12,999,369 miles, which include 486,294 miles of wire on independent farmer or rural lines, while the telegraph systems used 1,570,773 miles, exclusive of 7,188 miles of leased wire.

The grand total of ocean cable was 46,301 nautical miles, all controlled by the commercial telegraph systems.

The grand total of salaried officials. clerks, etc., was 29,470, of whom 25,298 were employed by the telephone systems and 4,172 by the commercial telegraph. The telephone officials, etc., received in salaries $19,298,423, and the telegraph clerks $2,794,937. The total of 142,733 wage-earners is divided, 118,871 belonging to the telephone systems and receiving in wages $48,980,704, while the 23,862 telegraph wage-earners were paid $15,013,312.

The grand total income was $236,045,615, of which the telephone concerns earned $184,461,747, expending $140,802,305, and the telegraph system earned $51,583,868, expending $41,879,613. Of the whole number of systems in operation, the telephone formed 99.9 per cent.

The surprising thing about this report is the rapid growth of the telephone business, which is still far from the height of its possibilities.

Engineers Endorse Electric Headlight.

According to the testimony given before the Washington State Railroad Commission at Olympia last week by E. H. Stewart and George Barnhart, engineers on the Oregon Railway and Navigation Company's lines, and G. E. Foster, an engineer on the Northern Pacific, there is no comparison between the electric and acetylene headlights. The electric headlight, in the opinion of the engineers, is the only light to be considered.

E. H. Stewart stated that he had run behind both electric and acetylene headlights, and he was outspoken in favor of the electric light. He said it showed the track much farther ahead and that there was no additional trouble in distinguishing the various colored lights along the track.

George Barnhart said he had been riding in an engine cab for twenty-five years and had had both electric and acetylene headlights on his locomotives. He is an enthusiast over the electric light and declares that the stronger light does not bother his eyes in the least.

G. E. Foster, of the Northern Pacific, also testified as to the superior merits of the electric light. He said he had had only electric lights on his engines, but stated that he has never had the least bit of trouble with them.

X-Ray as Leprosy Cure.

The X-ray as a cure for some cases of leprosy has been demonstrated by the American health authorities in the Philippines, according to Dr. Victor G. Heiser, chief quarantine officer at Washington, D. C.

Dr. Heiser, in a report to Surgeon-General Wyman, says the X-ray is suitable only for specially selected cases, and is valuable apparently only in the early stages. San Lazaro Hospital, Manila, was the first institution in the world to use the X-ray for leprosy treatment.

Official figures show that on March 31, 1909, there were 2,446 lepers in the Philippines, segregation having reduced by more than 1,000 the number of cases during the last two years. At the beginning of the American occupation, eleven years ago, there were nearly 4,000 lepers.

Telephoning Across the Ocean.

A fresh experiment is to be made with a method of promoting submarine telephony devised several years ago by Prof. M. I. Pupin, of Columbia University. It consists of the introduction, at carefully computed intervals, in the cable, of choking coils. These increase the distance at which speech can be made audible, not by magnifying the sound, but by lessening the rapidity with which electric vibrations die out. According to the London *Times,* the British government—doubtless in co-operation with that of France—has decided to lay a cable prepared in this manner across the English Channel. As it will connect with land lines at Dover and Calais, it is expected to facilitate telephonic communication between London and Paris. Though some use of Professor Pupin's invention has been made in the United States to enhance the efficiency of the American Bell Telephone Company's overland wires, it has thus far had only one trial under water—on a telephone cable which crosses Lake Constance from Switzerland to Germany. As for some reason the pioneer experiment has not proved entirely satisfactory, the outcome of the second trial under water will be awaited with exceptional interest.

If in this instance the system should work perfectly, it is not unlikely that there would be a fresh discussion of the feasibility of transatlantic telephony. It has repeatedly been pointed out that even if all the technical difficulties in the way of such an enterprise should be overcome it might not prove commercially successful. The hours during which a telephone line between New York and London would be patronized would be limited, and the cable devoted to such service would cost much more than one for telegraphy alone. It is to be remembered, however, that a cable equipped with choking coils could be employed for telegraphy as well as telephony. It would not necessarily lie idle, therefore, when it was not used for conversation.

Cipher Telegraph Rates Advanced.

An increase of rates on code messages has been announced by the Western Union and Postal Telegraph companies. Cipher messages will be charged at the rate of five letters to the word, instead of ten letters, unless the telegram is made up of only such words as can be found in the dictionary. Domestic messages only are affected.

The Michigan Electric Association.

Sixth Annual Convention, Detroit, Mich., August 17, 18, 19.

With an attendance that surpassed that of any previous meetings, the sixth annual convention of the Michigan Electric Association was held in Detroit, Mich., August 17, 18, and 19.

This convention, viewed from every standpoint, will be considered most successful. Central-station men from the far corners of the state were in attendance, as was also a representative gathering of manufacturers who conducted a number of interesting exhibits.

The meetings were held in the convention hall of the Hotel Tuller. A gratifying spirit of activity and interest was shown by the members and, although the discussions which followed the reading of the various papers were brief, unvarying attention was maintained throughout the presentation of all of the papers.

TUESDAY EVENING SESSION.

The convention was formally opened at 8 o'clock, Tuesday evening, by President H. W. Hillman. In his presidential address Mr. Hillman said in part:

It is my pleasure to address you once more in connection with the opening of this, your sixth annual convention. The object of this association shall be to foster and promote the common interests of its members and to advance scientific and practical knowledge in all matters relating to electric-light and power companies.

Notwithstanding the intensely interesting character of our industry, there has probably never been a time when your Association has given more attention to the subject of incandescent lamps. It seems apropos to call this a tungsten session, and to spend several hours rehearsing the evidences of advancement in connection with the subject of tungsten electric lights.

The heating branch of the industry has likewise advanced since your last meeting. The heating committee of this association has an interesting report to make at our third session, and in addition to the many papers that have been planned it would seem that this organization is not lagging on this most important subject.

Electrochemical and electrometallurgical matters are constantly coming before the central stations for discussion and handling. For fear your Association will make the mistake to fail to advance scientific and practical knowledge in all electrical matters, I would recommend that the incoming president appoint a committee of three members to be known as the committee on electrochemical and electrometallurgical matters.

The situation regarding electric motors is one which could be studied more than ever with the prospect of excellent results. At this meeting unusual importance will be attached to the forcible presentation of the merits of the curve-drawing wattmeters, and their value with relation to electric motor drive. Experience and careful study would seem to indicate that the curve-drawing wattmeter is as important to the electric motor branch of our industry as illuminating engineering has proved to be in relation to the lighting field. Therefore, it is hoped that every member will not only absorb but digest all that the papers have to offer on this subject so that central stations in Michigan will be the first to benefit from the extensive use of the curve-drawing wattmeters.

At the close of his address Mr. Hillman introduced E. G. Bieg, of the General Electric Company, who read a paper entitled "The Supremacy of the Tungsten Lamp." Mr. Bieg's paper describes the process of manufacturing the tungsten lamp. It deals quite fully with the supremacy of this lamp for both interior and exterior lighting. Mr. Bieg also advocates tungsten sign lighting, and gives some figures showing the comparative costs and comparative illumination between the tungsten and carbon lamps, which indicates the domination of the lighting field with the tungsten lamps.

The next paper was read by B. F. Fisher, Jr., on "Tungsten Lamps." Mr. Fisher said in part:

The introduction of a small step-down transformer opens another important field of usefulness for the tungsten lamp. The twenty-five-watt or twenty-candlepower lamp appears to be the smallest practical capacity for a unit at regular voltages, but by the introduction of a small auto-transformer it is practical to step down the standard voltages to twenty-seven or twenty-eight volts.

Another line of these new lamps which is of very great importance is the series lamp for street lighting, which should enable the central stations to compete favorably with the gas lamp for this class of lighting.

The tungsten lamps have the highest efficiency of any lighting units, excepting the larger arc lamps, said the author, and they burn with a clear, soft white light at approximately 1.25 watts per candle. This high efficiency is important to central-station management in its effect in flattening out the load peak without seriously reducing station output, and in the increased capacity of station apparatus and lines and the direct saving in cost of station and line apparatus due to the reduction of the load peak by the higher efficiency.

Next to the efficiency of the tungsten lamp its most important characteristic is the quality of light. To the storekeeper this quality of light produced is of far greater importance than the efficiency. In the home the quality of light permits combinations which are a constant pleasure.

The simplicity of the tungsten lamp is a characteristic which is often neglected. They retain all the simplicity of the ordinary incandescent lamp and require but little extra care.

Mr. Fisher was followed by Fred Masterson, of Grand Rapids, who read a paper entitled "Care of Tungsten Street Lamps."

Mr. Masterson's paper was devoted to a study of the installation of tungsten lamps for street illumination in Grand Rapids. He described the installation briefly and said that considerable trouble was experienced at first in renewing burned-out lamps, as it was necessary to draw the arches to one side of the street so that the lamps could be reached from a ladder placed against the building. This system required four men and also did considerable damage to lamps which did not need attention and also to the wiring. This original method was superseded by a tower wagon, similar to the ones used by traction companies for repairing trolley wires, and a considerable saving has been the result.

On June 8, 1909, the first installation of 270 lamps had been in operation one year. During this time the lamps burned 1,920 hours and consumed 41,000 kilowatt-hours of energy. The number of lamps renewed was 196, which cost the company $225; this makes the cost of renewals for lamps only $0.0055 per kilowatt-hour. The labor necessary to care for 270 lamps is $50, which makes the total cost of renewals $0.0067 per kilowatt-hour.

The one drawback of the series tungsten lamp, operating from a constant potential circuit, is the extinguishing of all the lamps in the arch when one lamp burns out. However, this is not very serious, if the lamps are inspected every morning.

The next paper, entitled "The Tungsten Lamp in the Residence," was submitted by John Vanderliet. Owing to the absence of the author, the president called upon William Constable to read Mr. Vanderliet's paper. The author said in part:

The residence lighting of the central-station business not only increases the popularity of electricity, but many times is the means of procuring new power customers.

It seems that the fixture manufacturers have in the past given very little attention to the art of illuminating engineering. The many kinds, sizes and shapes of shades found in the residences are proof of the fixture manufacturer's idea of what would sell rather than what would be useful for proper illumination. In most of the cases that he had personally investigated he found that the lamps were hung on an angle of about forty-five degrees, with a close-fitting frosted or colored shade, and very often in addition to this a frosted carbon-filament lamp is used. In very few cases did he find the proper shades used.

The policy of Mr. Vanderliet's company is to have two men make a systematic canvass of the residence customers and install a combination of forty-watt tungsten lamps, with the E5 Holophane reflectors, using Benjamin tungsten adapters on thirty days' trial, after which they send a man to see how the consumers are satisfied, and in nearly every case the customer sees enough improvement in his light to warrant the purchasing of the outfit.

The tungsten lamp, he believes, is the salvation of electricity against the gas mantle in the home.

Mr. Vanderliet's paper was followed by an address by J. R. Cravath, of Chicago. Mr. Cravath selected for his subject "Illumination," reviewing the reflector situation and discussing problems in illuminating engineering to be met with in modern installations, particularly regarding reflectors. By means of a blackboard Mr. Cravath illustrated the various angles of reflection obtained from several satisfactory and unsatisfactory reflectors now in general use.

Mr. Benson, of the General Electric Company, read letters from several central-station companies from outside the state of Michigan giving their opinions of tungsten lamps. His collection consisted of letters from the Union Power Company, St. Louis, Mo.; Commonwealth Edison Company, Chicago, Ill., and Kansas City Electric Company. Every letter spoke of the tungsten lamp as holding the same position in the electric-lighting industry that the Welsbach mantle has in the gas industry.

Mr. Benson was followed by W. J. Trotte, who said that his town was inaugurating the tungsten street-lighting system as installed in Grand Rapids, and with much success. He also added that with the general adoption of the tungsten lamp for both interior and street lighting the central stations were starting on a new era of prosperity.

Following the reading of the papers A. C. Marshall, of Port Huron, related the progress of the tungsten lamps in Port Huron. He said that the first installation of tungsten lamps was invariably followed by the customer reducing his lighting bill, but this reduction was more than covered by increase in number of people desiring electric lights.

Mr. Phillips, of Detroit, said, from statistics he was able to show, that in the various suburbs of Detroit the tungsten lamp was the means by which the central station was undoubtedly getting business from the gas companies.

Harry Fee, of Adrian, Mich., said that formerly the gas company in Adrian controlled the greater share of business, but with the introduction of tungsten lamps for street and residence lighting the business of the central station was increasing and that of the gas company decreasing. There is a successful installation in Adrian of twenty-two arches of forty-watt tungsten lamps for street lighting.

Messrs. Prindle, Wilkins and Brown all spoke of similar successful installations of tungsten lamps for both interior and exterior lighting.

WEDNESDAY MORNING SESSION.

The second session was held at 10 o'clock Wednesday morning. The first paper to be read was one by M. S. Mead, entitled "Electric Power Equipment in the Brunswick-Balke Company's Plant." Owing to the absence of Mr. Mead, F. F. Masterson read the paper.

In 1906 the Brunswick-Balke-Collender Company erected three large factory buildings for manufacturing billiard and pool tables, modern bowling alleys and store fixtures. When investigating the matter of power, the company was appealed to with arguments in favor of its own steam and electric plant, likewise with many in favor of purchasing the power from the Grand Rapids-Muskegon Power Company.

The latter proposition included the entire supply of power at the switchboard, eliminating any initial expense. The management was attracted to the simple arrangement of producing steam only for dry kilns and for heat without complications required for manufacturing its own power.

In October, 1906, there were installed ninety-two 440-volt, three-phase, Fort Wayne induction motors and four Westinghouse elevator motors, making a total of 923 horsepower connected. The power company installed two Westinghouse 6,600 440-volt, oil-cooled transformers, of 350-kilowatt capacity each, and commenced to furnish us power under a three-year contract.

In the fall of 1908 two additional factory buildings were completed. Instead of having to consider extensions of boiler, engine and generator capacity, the company simply purchased new motors, arranged for wiring the buildings and the supply was taken from the transformers which were ample in size for increased facilities. There was installed an additional equipment of twenty-one General Electric motors, a Fort Wayne elevator motor and a General Electric elevator motor, making a total of 390 horsepower.

In March, 1909, another contract was closed with the Grand Rapids-Muskegon Power Company and the Brunswick-Balke company, covering about 1,300 horsepower connected. Before making this last contract the most exhaustive tests were made to determine the amount of steam heat required, the amount of refuse available and the amount of additional coal necessary for steam heat, as well as the total amount of horsepower-hours which would be required from the power company. This test proved that the then existing system of boilers especially arranged for steam heat and the supply of current for light and power from the power company was the most economical arrangement that could be adopted.

Mr. Masterson was followed by Chas. H. Scott, of the General Electric Company, who read a paper also dealing with electrical installation of woodworking plants.

At the conclusion of the reading of Mr. Scott's paper, W. B. Wreaks, of the Westinghouse Company, made an introductory address on the papers by J. M. Van Splunter and Paul MacGahan, on "Graphic Recording and Curve-Drawing Wattmeters." Mr. Wreaks said in part:

"I have been requested to make a brief introductory address on a subject of the greatest importance and interest to all of you, who are operating central stations, in the intelligent building up of your business, and that subject is the curve-drawing wattmeter and the very great importance of its use to increase your motor business.

"I think you will all recognize and will admit of the importance of equalizing the load on your power-generating stations, and the fact that the higher your average all-day load and the lower your peak is compared with the rated capacity of the plant installed, the more economically you are operating, and consequently the greater your percentage of profit per horsepower generated or per dollar invested.

"With the great advance of electricity today almost every factory can be operated at a lower cost by driving machines by electric motors. Many manufacturers are far-sighted enough to see this, but there are, unfortunately, many who are not yet convinced of this economy. When such a factory manager, who has been driving his machinery by steam power, is approached by you to install motors, he tells you he is making his power for a much smaller rate than you can quote him. As a matter of fact, he has not usually any knowledge at all of the cost of his power, for he bases his conclusions on the readings of his indicator cards taken from his engine, and this is very incomplete, for it gives him instantaneous power readings only, and does not show load variations. It is up to you, gentlemen, to show him wherein he is wrong by an accurate power test, for in electricity you have the only possible accurate method for determining these results.

"This can be shown by a trial installation of motors properly applied to the machines. How many of you use the proper means to determine accurately the results of such tests?

"The curve-drawing wattmeter will give a graphic record during every minute of the day with the load variations of every machine, or group of machines, and give you the load factor and the record of running time and rest of every machine and group of machines.

"Gentlemen, every one of you who are operating central-station power plants should not only have a curve-drawing wattmeter on your switchboard for permanent use, but you should have at least two such instruments for the use of your power solicitors, to assist them in getting motor customers."

Following Mr. Wreaks' address, Paul MacGahan read a paper entitled "Graphic Recording Meters." An abstract of Mr. MacGahan's paper follows:

The subject of graphic or recording electrical instruments is in general by no means a new one, but the advantages accruing from the use of these devices have only recently been properly understood.

Graphic meters may be classified in a manner similar to other electrical instruments, with regard to character of service and accuracy desired. The service classification falls naturally into two groups: (1) Switchboard or permanent location and (2) Portable Service. The classification as to accuracy is subject to almost as radical a distinction as that of service, and may be stated as follows: (A) Meters in which simplicity of parts

or manipulation as well as low cost have been the determining factors in the design. (B) Meters in which accuracy has been made the prime requisite.

The instruments under class A consist generally of a very simple electrical movement, such as stationary coils attracting movable iron armatures and actuating directly a pen-arm fitted with a rudimentary pen. The pen travels in the arc of a circle, across a circular dial plate, which is made to rotate by means of a clock. This type of instrument, on the whole, is exceedingly simple, easily understood and manipulated, and reasonably reliable, but very much lacking in absolute accuracy.

In order to increase the accuracy of the instruments (class B), it is necessary to separate the functions of the measuring element and of the marking device, for the reason that the friction introduced by the pen on the paper interferes seriously with the accuracy. This cannot be satisfactorily overcome by increasing the power of the meter coils, owing to the electrical errors thereby introduced. Moreover, increased accuracy also requires a broader and more legible chart, which would still further increase the work required of the meter element.

Among the numerous applications which the advent of these higher accuracy types of instruments have developed and which were not previously considered possible, may be mentioned the following:

A basis for charging for power according to the maximum demand, or the peaks lasting a certain length of time; the analysis of power requirements for motor drive of machine tools, rolling mills, etc.; a complete record of the speed and output of printing presses, where speed and output are of prime importance.

"Curve-Drawing Instruments and Some of Their Applications" was the title of a paper by J. M. Van Splunter that was read by Mr. Freeman, following Mr. MacGahan's paper.

In this paper the author pointed out that in keeping with the rapid advance in the design of electrical apparatus have come improved methods in their use, for instance, in power equipment of factories and in the records kept showing the distribution of the load over the factory, the power used per machine and the character of the load. To obtain these results, data obtained from the records of curve-drawing instruments are so complete that the situation can be sized up in every detail and necessary corrections and changes made at the correct point.

If central stations would procure a curve-drawing wattmeter for demonstration purposes, it would soon result in increased motor sales, as the record would forcibly show the actual conditions throughout the day.

The cost of such an instrument is but nominal, but it must be pointed out that first cost must not be the only thing to consider, as the saving made by its various uses is of prime importance.

There are several types of curve-drawing instruments on the market, and in selecting instruments it is well to consider the different types and select one which at a nominal cost will give results which are within the limits of accuracy allowable.

By using curve-drawing instruments it is possible to show just how much power each machine takes, how long each day it is in use, and the cost of power for its operation. Such records also show with what promptness the employes start to work and also their time of shutting down. Furthermore, they tell when it is necessary to install new machines, and when by some changes fewer machines can be made to do the required work.

Mr. Fleming, of the Westinghouse Company, presented a number of lantern slides showing curves obtained from curve-drawing wattmeters.

After the reading of the above papers Miss Sheridun, of Detroit, started the discussion. She spoke in favor of the curve-drawing wattmeter, expressing a desire that they would become universally used. A number of cases were cited in which the instrument settled many complaints.

Mr. Denman, of Detroit, was not so enthusiastic over the subject, saying that the field for the instruments is limited. He added that in cases of dispute over bills, if the meters are read every morning and every evening for a week, the same general result can be obtained as with a curve-drawing wattmeter.

A. C. MARSHALL,
President-Elect Michigan Electric Association.

President H. W. Hillman ended the discussion by adding, that, in his opinion, there is nothing in the steam industry that can approach the curve-drawing wattmeter in the electrical industry.

THURSDAY MORNING SESSION.

The third and final session of this convention was held at 10 o'clock Thursday morning, and was opened by the reading of a paper entitled "The Extension of the Heating-Service Business," by J. D. A. Cross.

Mr. Cross took up the growth of electric heating and cooking appliances and described a complete hotel equipment of kitchen and laundry devices. He discussed flatirons and electric toasters, advising central stations to pay more attention to this branch of the industry. Mr. Cross called the attention of central-station men to the oil-tempering bath, showing the advantages of the electric over differently heated baths. Electrically heated ornamental ware, such as chafing dishes, percolators and teakettles, was discussed, Mr. Cross outlining methods of demonstrating this to the trade.

Following the reading of the paper by Mr. Cross, the president called for the report of the electric heating committee, which was read by William Constable, the chairman.

The report covers the entire field of electric heating, citing those branches which have advanced more rapidly than others. The range of possible uses of electric heat for industrial purposes was discussed, showing the variety of applications in which electric heat is used, such as in electric welders, printing and publishing trades, leather trades, clothing and textile trade, and branches of the woodworking trades.

Mr. Hillman read an abstract of a paper by Charles J. Russel, that was presented before the National Electric Light Association at Atlantic City, N. J., last June, entitled "Electric Heating Devices for Industrial Purposes."

Mr. Little read a paper on central-station advertising, outlining methods of successful advertising that have been employed by a number of central stations.

The report of the treasurer was read and accepted on motion.

The nominating committee announced the candidates for officers and, on motion, their recommendations were adopted and the following officers declared duly elected:

President, A. C. Marshall, Port Huron.

Vice-president, Geo. Westover, Cadillac.

Secretary and treasurer, A. P. Biggs, Detroit.

A. C. Marshall, president-elect, has been identified with the officers of this association for several years, his previous office being that of secretary and treasurer. He is general manager of the Port Huron Light and Power Company, Port Huron, Mich.

ENTERTAINMENT.

The entertainment committee is to be congratulated on the excellent programme they provided for the entertainment of the members and guests.

On Wednesday morning the ladies were taken on a delightful automobile trip through the principal business and residence districts, the boulevards and drives.

In the afternoon the delegates and guests with their ladies were taken to Bennett Park in special cars to witness an interesting ball game between the Chicago and Detroit teams.

The entire party also attended, in a body, a very pleasing vaudeville enter-

tainment at the Temple Theatre Wednesday night.

On Thursday afternoon a special boat was secured for the exclusive use of the ladies, guests and members for a delightful and refreshing trip down the Detroit River to the Bois Blanc Island, where supper was served. En route the boat stopped at Livingston Cut, one of the great engineering projects of the present time. Returning, the boat passed by the entire illuminated river front and landed at the dock at 10:30 p. m.

MANUFACTURERS' EXHIBITS.

The Westinghouse Electric and Manufacturing Company made an elaborate exhibit of carbon and flaming-arc lamps, fans, small motors, sewing-machine motors, electric heaters, electric iron, cooking appliances, transformers and precision instruments. W. B. Wreaks, F. H. Adams, David Whiting and B. A. Harris represented the company.

The Nernst Lamp Company made a very interesting exhibit, showing its new form of ceiling lamp, special pendants and various ornate fixtures, equipped with screw-base and instantaneous-lighting units of low and high candlepower. The company was represented by Max Harris, of Pittsburg, Pa., J. J. Sorber, of Chicago, Ill., H. M. Brown, of Detroit, Mich., and Frank A. Chapman, of Pittsburg, Pa.

The Shelby Electric Company made an exhibit of its lamps. It was represented by William H. Meyers and William Love.

The Excess Indicator Company made an interesting exhibit of its indicators; Bernard Gaines represented the company.

The Central Electric Company also made an interesting exhibit. R. L. Kimble represented the company.

Among other manufacturing and supply representatives present were: J. E. Hart, Banner Electric Company, Youngstown, Ohio; Fred M. Odena, Allis-Chalmers Company, Milwaukee, Wis.; J. R. Wiley, Standard Underground Cable Company, Chicago, Ill.; E. H. Cheney, Wagner Electric Company, Chicago, Ill.; C. H. Froelich, Federal Sign System-Electric, Chicago, Ill.; F. E. Case, Bryan-Marsh Company, Chicago, Ill.

That Ideal Storage Battery?

An inventor named Gross, living at Christiania, Norway, claims to have constructed an electric storage battery which is said to have the characteristics early predicted for the battery that long has occupied the attention of Thomas A. Edison.

Baltimore's Electric Light and Power Companies.

That the Susquehanna Electric Power Company, which has the only charter giving the right to engage in the electric-light and power business in Baltimore not controlled by the Consolidated Gas, Electric Light and Power Company, may exercise the rights of its charter and compete with the local company in distributing electric current was the statement made recently in Baltimore by William H. Surratt, vice-president of the corporation.

The company having paid its bonus tax of $15,000 on its capitalization of $12,000,000 at Annapolis, intends, according to Mr. Surratt, to begin the construction of a hydroelectric plant on the Susquehanna River as soon as several more millions of dollars are supplied by those interested in the corporation. Of the capital, more than $1,000,000 has been paid in, and Mr. Surratt said the indications were that the substantial interests behind the company would soon subscribe the additional money necessary to start the work of building a dam and power plant. Much property along the river above Conowingo, Md., has been acquired, he said, and the further financing of the enterprise within a short time is assured.

Besides selling its own current in Baltimore in competition with the Consolidated, it was stated by Mr. Surratt that the company might purchase current from the McCall Ferry Power Company and distribute it in Baltimore in conjunction with its own power, provided the market be found. The distribution of the McCall company's power, he declared, was contingent upon the action of the receivers of that company in regard to the contract held by the Consolidated for the exclusive distribution of the McCall power within a radius of twenty-five miles of the Washington Monument in Baltimore.

The Susquehanna Electric Power Company was incorporated in Howard County in 1895 by Charles T. Davis, Randolph N. Brown, M. H. Houseman and William Gilmor. None of these gentlemen is now in control.

The following officers were elected at a meeting of the directors and stockholders in January of this year at Belair:

President, Joseph W. Marsh, Pittsburg.

Vice-president, William H. Surratt, Baltimore.

Secretary, John Henry Miller, Baltimore.

The directors are mostly Baltimoreans.

Faster Telegraph Service.

The Postal Telegraph Company announces that beginning with August 2 it had perfected a new and improved system which is styled "Special Rush Service."

By this service it claims to have reduced the time of sending and receiving messages by fifty per cent in more than 5,000 offices in all the important centers in the United States.

C. C. Adams, vice-president of the company, said that the new service had been made possible by a rigid supervision of all the processes incidental to the sending and receiving of a message and the fixing of a maximum time limit for these operations. In addition, the actual telegraphing of a message has been hastened by a new type of operating table which permits of the concentration of circuits.

The average elapsed time from the moment a messenger is called in New York to delivery in Chicago is now fifteen minutes; and recently one was sent from St. Louis to New Orleans in four minutes. The improved methods in expediting traffic over the wires has reduced the time of transit, so that now one may send a message and receive an answer from Chicago, Boston, St. Louis, Denver, San Francisco, and New Orleans in less than thirty minutes after the messenger has been signaled for.

Paris-New York by Wireless.

Advices from Paris state that the wireless station on the Eiffel Tower is receiving almost daily communications from New York, and it often picks up messages from Canada. The present installation, which belongs to the War Department, is only a temporary one. When a definite installation has been completed, the fittings of which, except, of course, the external ones, will be all under ground. Captain Ferie, director of the service, expects to talk regularly with New York without trouble. This condition, it is expected, will be reached about the end of September, if present plans are followed.

New Zealand Mine Tries Electric Pumping.

It is reported that the Crown Mines at Karankahake, North Island, New Zealand, will install a 550-kilowatt three-phase alternator, with motors and duplex pumps, having a capacity of 1,135 gallons of water a minute from a depth of 1,000 feet.

Another Atlantic Cable.

The Commercial company is now making ready to lay what is virtually a new Atlantic cable and one which will mark a radical departure in the development of cable telegraphy.

One of the existing cables that belongs to this company and runs between Cornwall, Eng., and Canso, N. S., will be cut in mid-ocean, east of the Grand Banks, and a new section laid from there to St. Johns, whence it will be continued direct to New York, the portion stretching from the point of severance to Canso, a distance of 1,300 miles, being picked up and used otherwise subsequently.

The new arrangement will increase by one-third the capacity of the cable, as it will divide it into two equal sections from New York to St. Johns and from St. Johns to London, with repeating instruments at St. Johns.

Early telegraphers would marvel at the speed and efficiency that cabling has now attained. The first Atlantic message, from Queen Victoria to President Buchanan, of sixty-seven words, took ninety minutes to transmit. Today two messages, one each way, can be sent at the same time along an undersea wire at the speed of fifty words a minute each. Almost beyond belief are some of the records achieved.

In 1891 the experiments over one Atlantic cable, to determine the longitude of McGill Observatory, Montreal, disclosed that electric signals were flashed from Montreal to Greenwich and back, some 8,000 miles, in one second.

Three years later the British Admiralty sent a message to Vancouver by cable and land line and received a reply within ninety seconds, the distance both ways being 13,000 miles.

In 1896 a message from Washington to London, in the inter-parliamentary chess match of that year, was transmitted by cable and a reply received within fourteen seconds.

Messages from President McKinley to the battlefield of Santiago in July, 1898, were sent and responses returned within twelve minutes.

On July 4, 1903, President Roosevelt sent a message around the world to inaugurate the cable at Manila, and it made the circuit of the globe in nine minutes, traveling 33,700 miles by cable and land lines.

In 1904 the results of the Anglo-Australian cricket matches were sent from Sydney to London, 14,341 miles, in exactly three minutes, though involving twelve repetitions, and 20,000 words of press dispatches, detailing the capture of Port Arthur, were forwarded in January, 1905, to New York and London, within twelve hours.

United Railways Investment's Recently Organized Companies.

The recent incorporation in Maine of the Railroads and Power Development Company is the latest move in the organization by the United Railways Investment Company of a succession of companies to take care of the increasing public-utility requirements of San Francisco. This new company is to be the holding company for the Stanislaus Power Development Company and the San Francisco Electric Railways (which is to acquire and operate street railroads in San Francisco) and will also hold $10,000,000 of the $18,800,000 common stock of the United Railroads of San Francisco, which will be sold to it by the Investment company.

There will be no public offering of the new company's stock, which is all to be owned by the Investment company. If any public offering of securities of the subsidiary companies of the Investment company is made, they will be issued by the Stanislaus Power Development Company. The latter is to acquire the properties of the Stanislaus Electric Power and the Tuolumne Water Power companies under a plan of reorganization which provides for the issuance of a first mortgage on the property to furnish funds for the acquisition and completion of the plant and transmission lines and payment of existing obligations, and also an issue of $6,000,000 second mortgage five per cent bonds to be exchanged for the $6,000,000 first mortgage bonds of the Stanislaus Electric Power Company. In 1910 the Stanislaus Power Development Company will, it is believed, be in a position to deliver power to the United Railroads, and it is expected that when the property has been fully developed there will be a large amount of surplus power to sell.

The following table gives the combined statement of the earnings of the Investment company's properties for the six months ended June 30:

SIX MONTHS GROSS.

	1909.	1908.	Changes.
Philadelphia Co...	$ 8,952,383	$ 8,620,949	*$331,434
United Rys. of S. F.	3,568,904	3,341,452	*227,452
Total	$12,521,287	$11,962,401	*$558,886

OPERATING EXPENSES.

Philadelphia Co...	$ 4,751,634	$ 5,064,544	†$312,910
United Rys. of S. F.	2,085,332	2,209,116	†123,784
Total	$ 6,836,966	$ 7,273,660	†$436,694

NET.

Philadelphia Co...	$ 4,200,749	$ 3,558,405	*$642,344
United Rys. of S. F.	1,483,571	1,132,336	*351,235
Total	$ 5,684,320	$ 4,690,741	*$993,579

* Increase. † Decrease.

The Investment company itself, the income of which is dependent upon dividends paid on the stock of the two above-mentioned properties, should show a surplus available for dividends for the year 1909 of approximately $550,000. Before any dividends can be paid on the company's preferred stock, however, nearly a million and a half outstanding interest-bearing scrip, which was issued in lieu of cash dividends in April and July, 1906, and January, 1907, must be paid off.

Long Island Electric.

A hearing was held last week before New York Public Service Commissioner Bassett on the application of the Long Island Electric Railway Company for a reduction of its capital stock from $2,100,000 to $600,000. The Long Island company owns and operates a line of seventeen miles long, extending from the Borough of Brooklyn to Jamaica and Far Rockaway, with a branch running to Belmont Park.

The company was originally organized with an authorized capital of $600,000 and was afterward consolidated with the New York & North Shore Railway Company. This company had an authorized capital of $1,000,000, and previous to the consolidation agreement mortgaged its property and issued bonds to the par value of $1,261,000.

A $10,000 Prize for Inventors.

The Turin Chamber of Commerce will award a prize of 50,000 francs to the owner of an invention or discovery (not discovered or published before 1908) that will prove in practice advantageous to the national economy, this in connection with the Turin Exposition of 1911. Applications must be made in French or Italian, and submitted on or before March 31, 1911, to the Commissione per il concorso a premis, Camera di Commercio, Torino, Italy, from whom particulars may also be obtained.

To Hire Out Electric Cookers.

The city of Aberdeen, Scotland, has decided to purchase a stock of electric heating and cooking apparatus, to hire out the same at a low figure.

DETAILS OF WATT-HOUR METER MANUFACTURE.—III.

BY JOSEPH B. BAKER.

REGISTERS.

General Construction.—The register is an important element of the electric meter, not only because it is the device by which the commercial operation of the meter is observed, but because careful construction is necessary to avoid undue friction, which would vitiate the most careful design and construction in other parts of the meter.

The gears and pinions of the train are manufactured on automatic machines and subjected to careful examination for imperfect teeth, and the assembled register is inspected for bad alinement, loose or bent dial hands, etc., which might cause excessive friction at some positions of the wheels.

In order to simplify the manufacture, by having a minimum number of different designs, many of the meter-manufacturing companies provide a small "intermediate" train, interposed between the meter shaft and the register. This enables a single pattern of register to serve for meters of several different capacities by changing the ratio of the intermediate train. Fig. 16 shows a direct-reading five-dial register for a T R W meter.

The register of the principal makes of motor meters consists of the frame, gear wheels and pinions, worm and worm wheel, staffs (wheel shafts), and dials and pointers. The register of the Westinghouse type C house-service meter, a rear view of which is shown in Fig. 17, is of the direct-reading type, no multiplying constants being employed. It has a large "counting train" (carrying the dials on its front, and hereafter termed the "dial train"), and an "intermediate train," which serves to transmit the motion of the rotating system to the dial train. The dial train is uniform for all meters of this line, and contains four gears and pinions having a gear ratio of ten to one, different values being assigned to the dials, according to the capacity of the meter. The intermediate train contains always the same number of gears and pinions—though of different ratios—between the "first drive" (pinion at top of meter shaft) and worm.

In the Westinghouse meter register the worm and worm wheel, constituting one drive of the register train, and the one having the highest ratio of reduction, is made the link between the intermediate train and the dial train, instead of being made the first drive from the meter shaft, as in other makes of meter—the T R W, Duncan, etc. The first drive in this meter is from a steel pinion on the meter shaft to a gear wheel in the intermediate train.

The advantages claimed for this design over the more usual one are that the transmission from worm to worm wheel absorbs less power when placed back in the intermediate train, on account of the comparatively low velocity of the worm at the stated distance from the first drive from the meter shaft; and that in a pinion and gear-wheel drive from the meter shaft there is much less practical liability of incipient binding, inaccurate meshing, and other causes of undue friction, due either to inaccurate construction or to dirt or defects of alinement coming in during the service life of the meter. Thus, an error in the height of

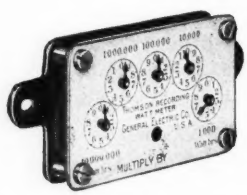


FIG. 16.—FIVE-DIAL REGISTER FOR T R W METER.

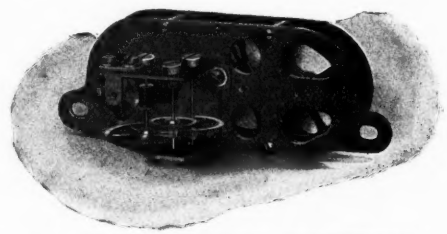


FIG. 17.—TYPE C METER REGISTERING MECHANISM.

the shaft in the meter, or in height of the disk on the shaft, would not affect the meshing of a pinion and gear-wheel drive, whereas it would affect the meshing of a worm and worm-wheel drive.

The accurate adjustment of the meshing of the pinion and gear wheel at the first drive is facilitated by designing the intermediate train to give a lateral offset between the staff of the first gear wheel and the meter shaft. That is, the staff is located to the left of and behind the meter shaft (looking from the back of the meter), so that for a given distance to right or left through which the register is shifted in assembling the latter on the meter shield, the gear wheel is shifted only a comparatively short distance obliquely.

Frames.—The register frame of the above meter is made in two parts, the frame of the dial train and the frame of the intermediate train. These are machined and assembled separately, each with its set of gears, and then connected together on the meter, so that the last drive of the intermediate train (a pinion) meshes with the first drive of the dial train (a gear wheel).

The frame of the dial train consists of a pair of brass plates, joined by four brass pillars. The plates, which are of one-sixteenth-inch brass, are blanked out to shape on a gang die. The next operation is to straighten the blanks, which come from the gang die more or less buckled. They are then drilled on jigs; the holes for the pillar supports which join the two plates of the frame, and for holding the intermediate train on the back of the dial train and the dial plate on the front of the same, being drilled full size at one operation; and the four holes in each blank for the four "staffs" (wheel shafts) being drilled under size. The blanks are next sent to the dip shop, where they are pickled in potash and acid baths, washed, and dried in sawdust. They are then treated to prevent corrosion, and the bearing holes reamed and burnished to exact size, employing a taper burnisher with a shoulder, which polishes not only the bearing surface in the thickness of the plate, but also a zone on the inner surface of the latter, adjacent to the hole, thereby preventing corrosion in or near the bearing. This feature, moreover, gives a free-running and a long-running register movement.

The above construction enables the two plates ultimately to be assembled on their pillars accurately parallel to each other, forming a rigid frame, with the bearing holes for the staff in true alinement.

The frame of the intermediate train is a U-shaped piece of one-sixteenth-inch brass, which goes through the following processes:

The frame is blanked out in the flat by a gang die, then bent up to shape, and drilled, tapped and countersunk in jigs, with special precautions to secure alinement. The train is designed differently from the dial train. The bottom ends of the three staffs each pass through a loose hole in the frame and bear on a hardened, polished steel plate, termed the "jewel," screwed on to the underside of

the frame; and the top ends bearing in the tips of bearing screws, which are tapped into the upper side of the frame. This construction gives a low-friction train, rendered advisable by the fact that the train includes a worm and worm wheel, and is immediately driven by the rotating element of the meter, or, in other words, by the high velocity of its members compared to the velocity of the members of the dial train. Although the members of the step bearing thus formed are of the same metal (steel and steel), the extreme lightness of the moving part and its low absolute velocity makes this form of bearing effective. The deposit of verdigris is prevented by the burnishing that the sleeve bearings and bearing screws receive in the process of reaming to size.

Gear Wheels and Pinions.—In making the gears, circular blanks of 0.025-inch "watch-wheel brass" are mounted, eighty or more at a time, on a mandrel, which is placed in an automatic gear-cutting machine having a cutter revolving at about 3,000 revolutions per minute. The first and last wheels of each lot are thrown away, on account of the burs which are formed on them by the cutter The diameter of the blanks is greater than that of the finished wheel, so that there is no chance of producing imperfect teeth, *i. e.,* every portion of every tooth has a cut surface.

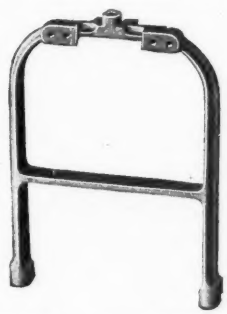


FIG. 18.—FRAME OF INTERMEDIATE TRAIN.

The gear unit—gear wheel, pinion and staff—of the dial train is assembled by the following four successive operations, formed on a monitor machine. With the wheel held in a revolving chuck, the center of the wheel is first countersunk to guide the drill, next the hole for the staff is drilled, and then reamed; lastly, with the chuck stationary, the staff fitted with its pinion is driven home. The position of the pinion close against the wheel gives a long friction surface for the staff, and the bind of the wheel on the staff is assisted by upsetting the surface of the former, adjacent to the hole. The front end of the staff consists of a straight portion constituting the front journal and a taper portion over which the hand or pointer is forced.

In the fourth gear unit of the dial train, and in the units of the intermediate train, the wheels are fitted with bosses forced into the center of the wheel and upset on the farther side; this construction is required by the fact that the wheel has no pinion adjacent to it, as in the gear units of the dial train. The assembling of the gear unit is affected by a monitor machine similar to the one used for the wheels of the dial train, performing the following operations in order: With the wheel held in a revolving chuck the center of the wheel is first countersunk to guide the drill; next the hole for the staff is drilled, and then reamed; lastly, with the chuck stationary, the staff is driven home, the pinion being forced on afterward.

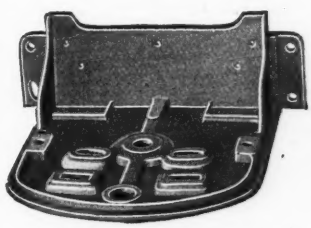


FIG. 19.—METER BASE.

In order to prevent corrosion of the register, all wheels and pinions are gold plated, a thin deposit of gold sufficing to prevent the formation of verdigris which might otherwise be caused by exposure of the meter to a corrosive atmosphere at its place of installation. The frames of the dial train and intermediate train do not need to be gold-plated, inasmuch as the bearing surfaces of the staff are burnished, as described above.

The pinions used in this meter register comprise brass pinions used in the dial and intermediate trains, and the steel pinion fixed to the top of the meter shaft and engaging with the first gear of the intermediate train to constitute the "first drive" of the register.

The brass pinions are cut from a fluted rod of pinion cross-section and finished individually. The steel pinions, which have a shoulder, are made from Stubbs' steel rod in a single automatic machine which does all but the finishing.

A point in connection with the assembling of the register on the meter shield should be mentioned here. In order to prevent risk of imperfect meshing of the shaft pinion with the first drive of the intermediate train at any time—as, for example, after swinging the latter away to turn back the register dials to zero position after final factory test—dowel pins are provided alongside the screws that hold the register on the shield. These dowels have to be put in after the meter is assembled, *i. e.,* after the first drive is meshed. Therefore, in drilling the holes for these dowel pins, an air suction is provided with an opening at the drill point, to carry away all metal borings that might otherwise get into the meter and cause trouble later.

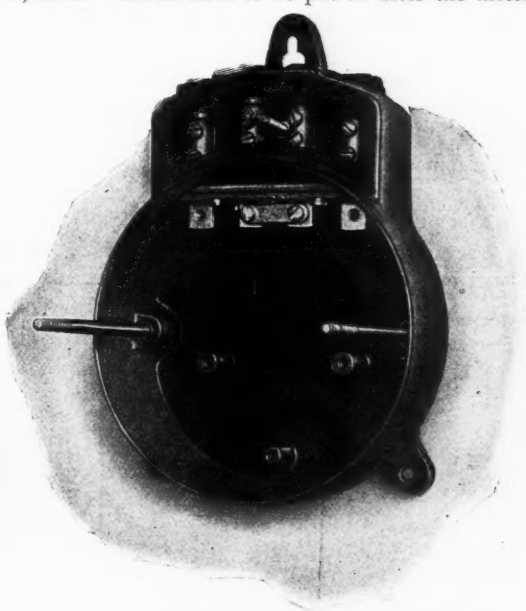


FIG. 20.—TYPE C ROUND PATTERN METER CASE.

Worms and Worm Wheels.—Worms are of brass, having single or double threads, and are made by an exact "chasing" method, similar to that employed on the Pratt & Whitney monitor lathe. In this method the cutting tool is held in a carriage which is moved along by a thread. The method is therefore superior to the ordinary method of cutting the worm with a die, which exerts torsion on the rod, and destroys the mathematical accuracy of the worm. Pains are expended in making the tool in such form that it may be sharpened, by grinding, without altering the shape or spacing of the cutting teeth.

Worm wheels are of brass, of thinner stock than the gear wheels described above. In cutting their teeth a mandrel filled with blanks is fed past a revolving

cutter, with a twisting motion given by a cam, which develops the desired pitch of the tooth to conform to the pitch of the worm. This method is superior to the usual method of cutting worm wheels, which is termed "hobbing with a tap;" and which consists in making an ordinary gear wheel and then finishing its teeth to pitch by a cutting steel worm.

Staffs.—In the design of the bearing surfaces of the staff, considerable end play is allowed. The staffs are made on an automatic machine, taking Stubbs' steel wire of a diameter equal to the largest diameter of the finished staff. The machine turns down the journal surfaces, and shoulders and cuts off the staff. The staffs made by this machine are more uniform as to length and diameter of bearing surfaces than hand-made staffs.

After hardening the staffs—which is done by quenching in oil to insure uniformity in temper—and burnishing their journal surfaces, they are ready for forcing into the wheels and pinions, or worm, as described above. The last operation on the staff and gear unit before assembling into the register train is to true up the staff by holding one end in a rapidly revolving lathe clutch, bearing on the other (or free) end with a tool so as to bend the shaft uniformly in every direction, and thereby force it to find its true central position.

Dial and Hands.—The dial is of porcelain on a copper plate, which is secured to the front plate of the dial train, preferably by two screws. This method of fastening the dial is superior to soldering, which has sometimes been employed, and which is liable to cause the dial plate to work loose, owing to corrosion of the solder in an acid or alkaline atmosphere. The dial circles, figures, etc., are fired on the porcelain.

The hands are stamped from sheet metal, finished dead black, and perforated at one end for a tight driving fit, which holds them firmly on the end of the dial train staff.

SHIELDS.

The shield of the meter is the main frame or base upon which the various parts of the meter are assembled. The use of the term "shield" is due to its incidental function, in many makes of meter, as a magnetic shield interposed between the field winding of the meter and the damping magnets, to prevent the latter from becoming demagnetized or reversed by powerful stray fields due to short-circuits or overloads through the meter. The shield is made of cast-iron for this purpose and provided with a partition between the meter magnets on one side and the field winding on the other. The term "shield" persists as a designation of this part, though the part is not now necessarily made of cast-iron.

The meter shield has undergone considerable improvement in recent years, in the direction of making all the parts of the meter mounted upon it accessible for inspection and adjustment. It may consist of a single light but rigid casting, designed to require a minimum amount of machine work upon it and to facilitate the assembling of the meter parts upon it with minimum labor cost. A two-piece frame made by the General Electric Company is shown in Figs. 18 and 19 on the preceding page.

Some manufacturers make their meter shields of an aluminum alloy high in aluminum, which gives a shield which is not only light, but free from danger of rust or corrosion. Certain other makers use cast-iron, as in the shield described below, and protect the iron after it has been machined by a non-rusting coating.

The shield of the Westinghouse type C induction meter is of gray iron, machine-molded, and nickel-plated after the first machining to protect from rust. The shield is machined on gang tools, with special precautions to make all surfaces and holes true with reference to the axis of the meter bearings. The two holes for these bearings—top bearing and jewel bearing—are reamed and then tapped by the use of guide reamers and taps. By reaming the top-bearing hole by a reamer having a spindle extension guided by the jewel-bearing hole, and then vice versa, the two holes are accurately alined with each other. The two holes are then tapped in the same manner.

All other holes in the shield are tapped before nickeling, and retapped afterward. This is done to clean out the iron dust which remains in the hole, owing to the use of oil required in the first tapping, and which would cause trouble sooner or later in the operation of the meter, by getting in between the jaws of the damping magnets.

The shield of the type C house-service meter, with parts assembled upon it, is held in the case by three screws, tapped with machined parts cast on the inside back of the case, as shown in Fig. 20, which is a view of a round-pattern meter case. The same screws pass through and secure the shunt-field core. The two top ones serve also to clamp the light-load adjustment loops after they have been set in calibrating the meter, as described elsewhere. The induction-meter shield described above is in marked contrast to the more open design of frames and bases for commutator meters, shown in Figs. 18 and 19.

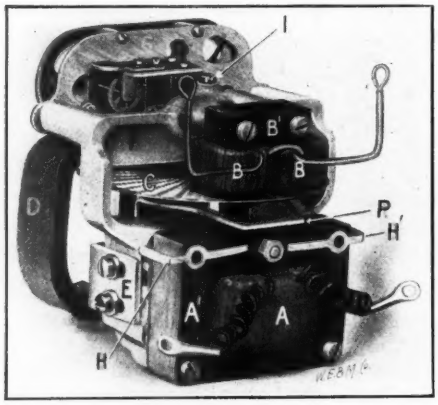


FIG. 21.—MECHANISM OF TYPE C HOUSE-SERVICE METER.

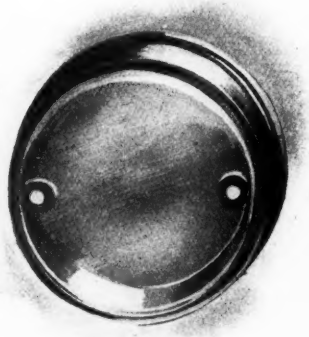


FIG. 22.—GLASS COVER FOR WESTINGHOUSE METER.

FIG. 23.—ALUMINUM COVER FOR WESTINGHOUSE ROUND PATTERN METER.

CASES AND COVERS.

The meter case, Fig. 20, may be of gray cast-iron, machine molded, of same quality as the cast-iron shield. In the above meter, the case is a rather shallow one, from which the meter proper (see Fig. 21) projects. It is accessible for repairs and adjustment, when the cover, which is relatively deep, is removed. It carries the lugs or hangers by means of which the meter is mounted at its place of installation; it forms the support for the shield, which is screwed to it; and it forms a support for the cover, which is held against it by threaded posts and wing nuts, with a gasket fitted between the shield and edge of cover.

The case is surfaced and profiled, drilled and tapped on gang machines to fit it for the meter base, cover and terminals. In order to secure the two cover posts firmly in the case, the tapped holes in the latter are broached into taper. square shape at the back of the case, and the ends of the posts are spread to fill the holes, after the latter are screwed

FIG. 24.—STYLE B COVER FOR DUNCAN SWITCHBOARD METERS.

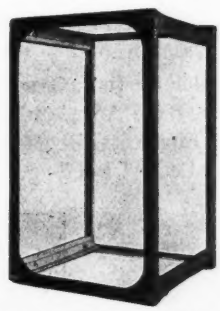


FIG. 25.—STYLE C COVER FOR DUNCAN SWITCHBOARD METERS.

home, thereby preventing the posts from turning or working loose.

The finish of this meter case is japan, applied by spraying. This method is preferable to brushing, as it insures that every crevice and cranny of the iron is penetrated and evenly coated with japan. Two coats are applied, baked on separately, to thoroughly protect the iron from rust.

Meter covers (Figs. 22 to 25) are made in a variety of shapes to conform to the design of the meter. In modern meters all-glass, all-metal, and glass and metal covers are used—the vogue of the first-mentioned being at present on the increase. The fact that the meter is equipped with a glass cover tends to insure better handling, not only of the cover, but of the meter, since it causes the workman or meter inspector to become more careful, instinctively. Another advantage is that it makes the meter more difficult to "beat," inasmuch as holes cannot be made in it, as they can in a metal cover, through which wires, etc., may be introduced to tamper with the mechanism. The latter is in plain sight through the cover, so that any mechanical or electrical tampering with the mechanism cannot be concealed from the next employe of the central-station company who may visit the installation. The installation of a glass-covered meter does not, of course, prevent the slowing down or even reversing of the meter by a magnet concealed nearby. Occasionally the electrical journals contain accounts of successful or unsuccessful attempts to defraud central-station companies by tampering with installed meters.

The glass covers used by the best makes are of strong, heavy molded glass. In the round-pattern Westinghouse meter cover shown in Fig. 22, the only toolwork on the cover after the molding and annealing is the grinding of the pads for the cover-post, wing nuts and washers. The round shape and certain features of design of this cover make it particularly strong; it is, in fact, more sturdy than the round aluminum cover which is furnished with the same meters. The glass cover is fitted with a gasket of rubber tubing, glued into the flanged rim.

The round aluminum Westinghouse meter cover, shown in the back view, Fig. 23, is pressed from pure sheet aluminum. The piece of glass for the windows through which the dials are read and the revolution of the disk observed has no frame, which facilitates its renewal if it is accidentally broken. The glass is held in place by three lugs, secured by brass nuts on the inside of the cover, and is sealed to the latter by putty, as shown, to make it insect, dust and moisture proof. The gasket is of felt, cemented to the flanged rim of the cover.

Metal and glass covers are employed mainly for switchboard meters, and usually consist of a metal skeleton frame of special finish to harmonize with the switchboard or its equipment, with plane glass let into it to make the meter visible from all sides. Typical covers of this type are shown, Figs. 24 and 25, respectively, the "Style B" and "Style C" covers of the Duncan Electric Manufacturing Company.

[To be continued.]

Long Island Railroad Company Wants $16,500,000.

The Public Service Commission, Second District, New York State, has received an application from the Long Island Railroad Company asking for an order authorizing it to issue debentures not to exceed in amount $16,500,000. It is stated in the petition that the Pennsylvania Railroad Company owns and holds 135,958 shares of the 240,000 shares of capital stock. The proceeds of the bonds are to be used to repay the Pennsylvania Railroad Company $6,032,951 loaned by that company and expended for various improvements during the years 1905 to 1908, inclusive.

The company states that it will require within the next three years additional capital for construction work and for equipment necessary to continue the improvements which have been commenced and on which large sums of money have been expended, to provide adequate and proper facilities and accommodations for continuing its business economically.

It is stated that the Pennsylvania company is willing to make further loans in addition to its existing indebtedness of $6,032,951 of $10,500,000, loans to be secured by the issue of ten-year four per cent debentures, and in such years that interest thereon cannot be paid by petitioner out of earnings authority is asked for permission to issue non-interest bearing debenture script convertible into debentures to be issued therefor, such debentures to be payable in cash or redeemed by the issue of some more permanent form of security when the financial condition of the company and its increased earnings justify an application for authority to issue such securities.

Montevideo's Trolley Systems.

There are two trolley systems in Montevideo, Uruguay, viz., Sociedad Commercial and Sociedad Transatlantica and one, via y Ferrocarri del Norte owned partly by the Uraguayan government and partly by private parties.

Electrical Days at the Alaska-Yukon-Pacific Exposition.

As previously announced, the recently organized Northwest Electric Light and Power Association will hold a joint meeting with the Seattle Section of the American Institute of Electrical Engineers at the Alaska-Yukon-Pacific Exposition on September 7, 8 and 9. The exposition management has set apart these three dates as special electrical days in honor of the members and guests of both these organizations.

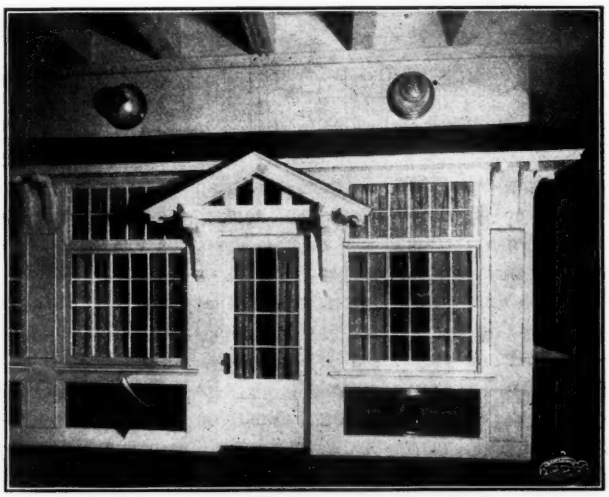
A special booth for the joint use of both societies has been completed at the exposition and is shown in the illustrations herewith. While it will be the particular center of interest on the three days in question, it has become regularly the headquarters of visiting electrical engineers in particular and of the engineering fraternity in general. The booth is in charge of an attractive young woman, who is ready to supply all necessary information concerning the exposition, the electrical features and the two societies. A supply of A. I. E. E. and other electrical literature is available. Visitors are expected to register with their business and residence addresses. The booth will remain open on week days throughout the exposition.

The regular meeting place of the Seattle Section of the American Institute of Electrical Engineers is on the eighth floor of the Central Building, in the business district of Seattle. The rooms are in the southwest corner of the building, directly under the observatory, and are very comfortably, though not luxuriously, arranged.

CENTRAL BUILDING, SEATTLE, WASH., HOME OF THE SEATTLE SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

INTERIOR VIEW IN THE CENTRAL BUILDING, HEADQUARTERS OF THE SEATTLE SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

INTERIOR OF THE ELECTRICAL BOOTH AT THE ALASKA-YUKON-PACIFIC EXPOSITION.



EXTERIOR OF THE ELECTRICAL BOOTH AT THE ALASKA-YUKON-PACIFIC EXPOSITION.

Went "Dry" and Goes Dark.

The town of Mattoon, Ill., has been obliged to close down the city lighting plant for want of enough funds to operate it. The city fathers at their last meeting heard representations as to the embarrassment of the city treasury, said to be due to the elimination of saloon-license contributions as a result of the town voting "dry" last fall. At that time nineteen saloons were voted out. City officials said public improvements would have to suspend and the publication of funds for the next school term will have to be considered. There was a brisk demand for lamps and tallow candles when the power house shut down last week.

Buys Chicago Property.

The property at the southwest corner of Fifth Avenue and Jackson Boulevard, Chicago, has been sold by William W. Cole, of New York city, to George A. McKinlock, president of the Central Electric Company, of Chicago, for $750,000.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company reports earnings for the month of July, 1909, and twelve months ended July 31, 1909, which compare as follows:

	1909.	1908.
Net earnings	$ 75,422	$ 60,702
Interest, coupons, etc	33,800	32,273
Surplus	$ 41,622	$ 28,429
Twelve months ended July 31:	1909.	1908.
Gross earnings	$2,315,519	$2,086,106
Expenses	1,302,240	1,219,785
Net earnings	$1,013,279	$ 866,321
Interest, coupons, etc	393,675	379,909
Surplus	$ 619,604	$ 486,412

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of July and twelve months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$ 234,101	$ 193,421
Expenses	9,403	4,000
July net	$ 224,698	$ 189,421
Twelve months gross	3,093,296	2,563,892
Expenses	80,190	37,563
Twelve months net	$3,013,106	$2,526,329

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 948,240	$ 898,210
Expenses	597,509	578,528
July net	$ 350,731	$ 319,682
Charges	232,449	232,852
July surplus	$ 118,282	$ 86,830
Seven months gross	6,339,815	6,061,765
Expenses	4,028,708	3,946,037
Seven months net	$2,311,107	$2,115,728
Charges	1,637,079	1,618,399
Seven months surplus	$ 674,028	$ 497,329

ILLINOIS TRACTION COMPANY.

The report of the Illinois Traction Company for the six months ended June 30 compares as follows:

	1909.	1908.
Six months gross	$2,054,217	$1,913,517
Expenses	1,218,121	1,138,593
Six months net	$ 836,096	$ 774,924

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company, of Philadelphia, for the month of July, 1909, compares as follows:

	1909.	1908.
July gross	$91,020	$88,336
Expenses and taxes	45,533	45,098
July net	$45,487	$43,238
Bonded interest and reserve	34,135	34,531
July surplus	$11,352	$ 8,707

AMERICAN TELEGRAPH AND TELEPHONE.

The American Telephone and Telegraph Company reports earnings for the month of July and for seven months ended July 31, 1909, compared as follows:

	1909.	1908.
Month July—		
Dividends	$ 2,670,722	$ 2,619,578
Interest and other revenue from associated companies	980,345	774,706
*Telephone traffic (net)	337,423	260,527
Real estate	6,494	15,692
Other sources	106,816	117,394
Total earnings	$ 4,101,802	$ 3,787,900
Expenses	205,887	173,991
Net earnings	$ 3,895,914	$ 3,613,908
Deduct interest	526,015	614,493
Surplus	$ 3,369,899	$ 2,999,415
January 1 to July 31—		
Dividends	$ 9,794,637	$ 9,062,922
Interest and other revenue from associated companies	6,134,869	5,726,495
*Telephone traffic (net)	2,426,553	2,076,392
Real estate	55,986	71,428
Other sources	902,587	459,053
Total earnings	$19,314,634	$17,396,292
Expenses	1,432,840	1,247,761
Net earnings	$17,881,794	$16,148,530
Deduct interest	4,418,639	4,486,169
Surplus	$13,463,154	$11,662,361
Dividends	7,631,291	6,120,092
Net surplus	$ 5,831,862	$ 5,542,269

*In 1909, all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December, as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expense for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908.

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies for the month of July and for seven months ended July 30, 1909, compared as follows:

	1909.	1908.
July—		
Gross earnings	$ 483,072	$ 446,835
Operating expenses and taxes	279,548	272,109
Net earnings	$ 203,524	$ 174,726
Interest and sinking fund.	106,250	105,742
Surplus applicable to dividends and reserves	$ 97,274	$ 68,984
American Cities companies' proportion of surplus on basis of stock ownership	$ 86,114	$ 61,080
American Cities' preferred dividend	34,530	34,530
Balance applicable to stock and reserves	$ 51,584	$ 26,550
Equivalent on outstanding American Cities' stock to	5.75%	2.96%
January 1 to July 31—		
Gross earnings	$ 3,258,818	$ 3,076,358
Operating expenses and taxes	1,888,309	1,856,856
Net earnings	$ 1,370,509	$ 1,219,502
Interest and sinking fund.	743,324	726,809
Surplus applicable to dividends and reserves.	$ 627,185	$ 492,693
American Cities' companies' proportion of surplus on basis of stock ownership	$ 554,095	$ 430,596
American Cities preferred dividend	241,713	241,713
Balance applicable to common stock and reserves	$ 312,382	$ 188,883
Equivalent on outstanding American Cities common stock to	4.98%	3.0%

The American Cities Company has outstanding $6,906,177 six per cent cumulative preferred and $10,761,165 common stock. It has no funded or floating debt.

The last annual report shows that the controlled companies are practically without floating debt and indicates that the companies' financial plans are sufficiently broad to take care of additional construction for many years to come.

The policy of the American Cities Company has been to better and enlarge its properties. Since the control of these properties by the present interests, including the period prior to their being acquired by the American Cities Company, there has been expended in betterments, improvements and extensions approximately $13,000,000, of which about $10,000,000 has been expended in the last five to six years. Gross earnings have nearly doubled in the last five years.

Commonwealth Edison Stockholders to Vote on Increasing Capital Stock.

The stockholders of the Commonwealth Edison Company, of Chicago, will vote, on November 9, the date of stockholders' annual meeting, on the proposition of increasing the authorized capitalization of the corporation from $30,000,000 to $40,000,000. It is the present intention, if the proposition carries, to offer $3,000,000 of the new capital stock to the stockholders at par, up to ten per cent of their present holdings. The proceeds of the sale of the stock will be used to cover cost of improvements and extensions during the coming year.

Would Divide Power Company.

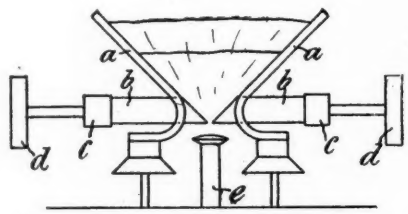
The Cliff Electrical Distributing Company was given a hearing last week by the New York Public Service Commission, Second District, on an application for an increase of its capital stock to $500,000 and to issue $1,500,000 mortgage bonds and for approval of the transfer to it of that part of the franchise and works of the Niagara Falls Hydraulic Power and Manufacturing Company relating to the generating and distribution of electric power, in which part of the petition the latter company joins.

The company was incorporated as a means to separate the electrical development and distributing properties of the Niagara Falls Hydraulic Power and Manufacturing Company from its other properties, the latter company, besides its hydraulic canal in Niagara Falls for furnishing water for power purposes, owning two flour mills and various pieces of real estate not connected with the electrical generating and distributing business.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE MANUFACTURE OF NITRIC ACID FROM THE AIR IN AUSTRIA BY THE PROCESS OF THE SALPETERSAEURE-INDUSTRIE-GESELLSCHAFT.

A method of obtaining nitric acid from the air has come into existence quietly in Austria, while the attention of the technical world was attracted by developments in this field in Norway. The inventors of this process are the brothers H. and G. Pauling, and it is being operated near Innsbruck by means of the waterpower of the Sill. The process is based on the utilization of flaming arcs, produced between electrodes having the form of the horn lightning arrester, as shown in the accompanying illustration. An arc started at the narrowest point of this lightning arrester travels upward, breaks at every half period of the alternating current and ignites again at the lowest or narrowest point. When an air current of high velocity is blown between the electrodes the arc is driven still further upward and may be made to reach a considerable length. The smallest distance between the electrodes must be sufficient to allow the passage of the enormous quantity of air to be burned, but as the starting of the arc between electrodes at such distance from each other would require an extremely high tension, a special igniting device is employed. The main electrodes *a* have slots at the point of smallest distance, through which so-called igniting blades, that can be approached to each other within a few millimetres, are introduced. These blades are very thin and do not disturb the movement of the air, so that it can enter the arc with full effect. The smallest distance between the main electrodes is about forty millimetres. Heated air is introduced through a nozzle, shaped so that the air spreads and flows along the electrodes. The length of the arc flame used in practice is about one metre. The water-cooled electrodes are of iron and last about 200 working hours. The igniting blades are consumed more quickly, and have to be adjusted to the necessary distance from time to time. The cooling of the gases is effected by so-called circulating air, that is, cooled reaction mixture, which enters from the sides into the upper part of the flame at a smaller velocity than that of the main air current and exerts a suction effect on the arc, thus increasing its length. Nitrous oxide concentration of about 1.5 per cent is obtained by this cooling method in operation on a large scale. The furnaces are of masonry, and the two arcs burning in each consume 400 kilowatts under a tension of about 4,000 volts. Six hundred cubic metres of air pass through the furnace in an hour, not including the circulating air. At the present time twenty-four such furnaces have been erected in the factory at Innsbruck. The gases leave the furnace at a temperature of 700 to 800 degrees centigrade, and are then worked up into nitric acid and nitrate of sodium. One of the difficult problems is the utilization of the heat contained in the furnace gases. It is used for heating the air and for evaporating the acid. The condensation is effected in a system of pipes and towers, and an acid of about forty per cent is obtained, which is concentrated to commercial acid of sixty per cent by utilizing the heat of the furnace gases. A plant for the manufacture of nitrate of sodium is connected with the installation, in which the nitrous oxides remaining in the air after absorption with water are utilized without waste. The yield amounts to sixty grammes nitrous acid per kilowatt-hour. The twenty-four furnaces so far installed at Innsbruck have a total capacity of 15,000 horsepower. Two other factories of 10,000 horsepower each are being erected, one in southern France, and one in northern Italy.—*Translated and abstracted from Zeitschrift für Elektrochemie (Halle), August 1.*



APPARATUS FOR MANUFACTURING NITRIC ACID FROM THE AIR.

AN ELECTRIC PLANT.

In the forests of India occurs a strange plant which is said to possess to a high degree astonishing magnetic power. The hand which breaks a leaf from it immediately receives a strong electric shock. At a distance of twenty feet a magnetic needle is affected by it, and it will be quite deranged if brought near. The energy of this singular influence varies with the hour of the day. It is most pronounced about two o'clock in the afternoon, but is ineffective during the night. At times of storm its intensity augments to striking proportions. While rain falls the plant seems to succumb, and it bends its head during a thunder shower; it remains there without force or virtue, even if one should shelter it with an umbrella. No shock is felt at that time in breaking the leaves, and the needle is unaffected beside it. It is stated that one never by any chance sees a bird or insect alight on the electric plant; an instinct seems to warn them that they would find sudden death. It is also important to remark that where it grows none of the magnetic metals are found, neither iron nor cobalt, nickel, an undeniable proof that the electric force belongs exclusively to the plant.—*Abstracted from The Engineer and Iron Trades Advertiser (Glasgow), July 20.*

AUTOMATIC TEMPERATURE REGULATION OF ELECTRIC FURNACES.

A novel and ingenious device for automatically regulating the temperature of an electric furnace was described recently by M. Kolswrat at a meeting of the French Physical Society. A pyrometer consisting of a platinum-platinum-rhodium thermo-couple is placed in the furnace, and is connected in the usual way to a galvanometer. On the pointer of the instrument is mounted a small mirror measuring four centimetres by five centimetres, and this mirror is so arranged that, when the temperature of the furnace increases and consequently the pointer moves over the scale of the galvanometer, at a predetermined point the rays of a Nernst lamp fall on the mirror and are reflected back on a sensitive thermopile, consisting of twenty copper-constantan junctions. The current generated in this latter thermopile is sufficient to actuate a system of relays, by means of which re-

sistances are introduced into the main circuit of the furnace. As soon as the resistance is switched in, the temperature of the furnace falls, and the pointer of the galvanometer with the mirror moves back to the zero point. The rays of the Nernst lamp are then no longer reflected on to the thermopile, and, the current in the latter falling to zero, the resistances are shunted out of the main circuit, and the temperature of the furnace commences to rise until the mirror comes into action again. This arrangement forms a very sensitive governor; it is especially sensitive when the apparatus is arranged on the potentiometer principle; that is to say, the electromotive-force generated by the thermo-couple in the furnace is balanced by a counter electromotive-force (from a standard cell with resistance), so that the galvanometer stands at zero when the temperature of the furnace is of the desired degree. Obviously the apparatus is easily adjustable for different temperatures. In a furnace working at 1,000 degrees centigrade the apparatus only permitted a variation of from two per cent to three per cent on either side. For all practical purposes that variation is sufficiently accurate, but this sensibility could be improved upon by employing a type of furnace which would respond more readily to an alteration of the current density.—*Abstracted from The Electrical Magazine and Engineering Monthly (London), August 14.*

SCHOOLS OF ELECTRIC COOKING.

An undeveloped field for electrical enterprise lies in the provision of schools in which cooking by electricity may be taught. Few existing cookery schools employ anything but gas, and in order that electric cooking may become popular it is advisable to give capable instruction to potential users before they purchase any apparatus at all. Few ladies could turn out a satisfactory dinner by the aid of a gas cooker used for the first time, and they cannot be expected to become adepts with an electric oven without some previous experience. Much of the difficulty which contractors meet with in selling such appliances is due to the disinclination of the average housewife to try something of which she has no knowledge. It is useless to describe the merits of an oven in the showroom, and it is nearly as useless, and it is expensive, to install one on trial. But invite a lady to attend a class or a course of private instruction, free of cost if necessary, without any suggestion as to buying, and she soon realizes for herself the possibilities of electric cooking and its superiority over any other system. Knowing how to use an electric oven, she would never afterward wish to employ anything else, and to sell apparatus to those who have had experience of its workings in practice is quite a simple matter. A novice may easily waste current and yet fail to get satisfactory results, but with the very same apparatus an experienced cook would be able to produce a well-cooked meal with perhaps fifty per cent less current consumption and in shorter time. If some enterprising contractor were to start a school, under the care of a capable cook, he would find that the demand for ovens, grills, and other domestic appliances would come of itself. In any such undertaking, he could rely upon the active support of manufacturers, and apart from the benefit which a cooking load would prove to central stations, there should be money in the scheme for the contractor.—*Abstracted from The Electrical Times (London), August 12.*

ELECTRIC DRIVE ON SHIPS.

Admitting that the steam turbine has made the four-crank triple-expansion engine practically obsolete, few will concede this to be the final solution of the problem of propelling ships. Suggestions for utilizing the reaction of explosive gas discharges may be dismissed without further consideration as being out of the question, if only for mechanical reasons. The amenability of electric drive would seem to recommend electricity as a means for propelling ships, although of course there are some very real difficulties to be overcome before its practicability can be assured. Some of these difficulties will require careful consideration, but they can all be overcome if boldly faced. A Liverpool critic points out that a serious obstacle arises from the liability of electrical insulation to break down under the influence of dampness. No doubt a breakdown such as is here suggested would be more than serious; would, indeed, under many conditions, quickly become disastrous. But hard as are the problems of effective insulation, they are by no means insuperable. We may take the comparatively and extremely humble example of trading laundries, where electricity is used not only for lighting, but as motive power, and as a means of heating irons and other appliances. In these cases constant annoyance was caused owing to the steam-laden atmosphere attacking the insulation. A little ingenuity has overcome the trouble. In marine engineering the problem is more intricate, though it is only a question of degree. Undoubtedly the designing of a suitable main motor is a formidable task. However, the prize is so enormous that it should prove a sufficient incentive to set our keenest wits to work on the problem, the chief features of which are: Constant running without liability to overheating; reversibility by controllers of large size; large initial torque, and yet capable of being run dead slow and at varying speeds for long periods without the windings and resistances becoming too hot; means to overcome difficulties arising from fluctuations of voltage, due to starting the main motors from a generator, and the variations of amperage due to drop of voltage at starting, and in maneuvering a ship on leaving or entering a port. Other points there are which assuredly cannot be settled in a day or in the course of a paper or two. As for the alarm as to a possible shortage of sea-going expert electricians, that may be set aside, for the demand will soon create the supply, as it has done in providing us with the competent steam-using engineers of today. For some time to come we must devote our attention to promote discussion, to experimentation, and to enlisting the interest and good-will of shipowners.—*Abstracted from The Electrical Engineer (London), August 13.*

The Interstate Commerce Commission.

While the Interstate Commerce Commission does not make any formal report covering the work of the commission for the fiscal year, yet it has just been announced that more work was completed by the commission during the past fiscal year, ended June 30, 1909, than during any previous year of its history.

On September 1, there were on the docket of the commission 416 cases, and from that time until June 30, 1909, there were 968 additional complaints filed, making a total of 1,384 live cases on the calendar during the fiscal year. It is also stated that during the year 629 cases were disposed of. Complainants' pleas for relief were granted in 252 cases and dismissed in 206 instances.

On June 30, 1909, there still remained on the docket 755 cases, many of which will be assigned during the next week or ten days for hearing, and it is said that as about 300 of the above cases involve the same principles they will be combined into four cases. A. F. T.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

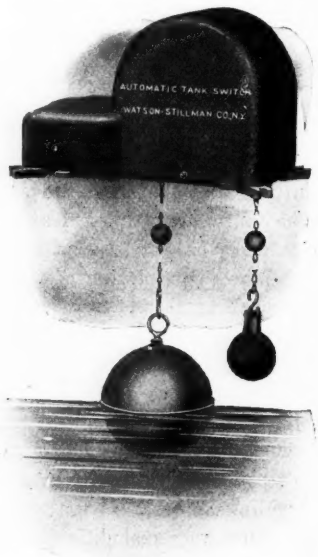
The New Watson-Stillman Automatic Tank Switch.

The automatic tank switch, illustrated herewith, is offered as a decided improvement over other switches for automatically maintaining the water level between desired limits in open tank or sump systems. The construction is novel, permitting the switch to be placed on top of the tank or sump cover, and permitting any desired variation in water levels to be carried without relocating the electrical apparatus. When the switch is placed on top of the tank, as in this instance, there is no necessity for boring a hole into the side of the tank and there is no danger of the switch flooding and becoming short-circuited.

The operation of the Watson-Stillman switch in starting and stopping the motor is dependent upon the movement of a falling hammer, the movement of which in turn is governed by a freely suspended copper float nearly counterbalanced by a cast-iron ball. Referring to the illustration, the two small wooden balls on the chain are adjustable and their position determines the variation of water level between operations of the pump. The switch is shown as when the pump is in operation. As the float rises, the ball comes into contact with the projection on the hammer and carries the hammer past the center. The hammer then falls to the other side of the pulley shaft by gravity, and in doing this a lug strikes a projection on the switch and disengages the knife, thus stopping the motor and pump The switch movement is quick. There is no chance for arcing, and as the hammer remains in contact with the switch arm, there can be no rebound. The hammer holds the switch arm in this position until falling of the water level brings the other wooden ball into contact with the hammer lug, which reverses the hammer, throws the knife into contact and starts the pump again. The wheel acts merely as a carrier for the copper chain. It plays no other part in the operation of the switch.

As arranged for draining sumps, the copper float and iron ball are reversed. This reverses the switch action to start the pump when the water level gets too high. Dampness will not affect the working qualities of the switch when it is placed in the pit.

The knife arm is thoroughly insulated from every other part of the switch, and the two contact points are mounted upon a slate block. A suitable opening is provided in the body for inserting the tube and making the connection to the binding posts. No parts of the switch need oiling or other attention. The shaft is of bronze, to prevent corrosion, and all parts are extra strong. All working parts are enclosed in a heavy cast-iron case, which protects them from the weather and from sudden injury.

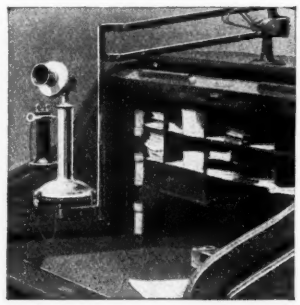


EXTERIOR VIEW OF THE WATSON-STILLMAN SWITCH AS ARRANGED FOR TANK WORK.

This switch may be had single or double pole and for all ordinary currents and voltages. It is made by the Watson-Stillman Company, 50 Church Street, New York, N. Y.

A Convenient and Practical Telephone Bracket.

The accompanying illustrations show the adaptability of the "Phone-Eze" telephone bracket which has been designed to eliminate a number of the troubles which obtain with the telephone instrument on a busy man's desk. This device can be attached to either a flat-top or a roll-top desk, and it takes the telephone off of the desk away from papers, inkwells, etc., and saves a considerable amount of lifting and moving around.



BRACKET ADJUSTED TO A ROLL-TOP DESK.

The cords are kept entirely out of the way, preventing entanglement with anything upon the desk. The apparatus is durably made, all of the parts are interchangeable and adjustable, and it is being received with considerable favor as a very useful adjunct to the business office.

BRACKET ADJUSTED TO A FLAT-TOP DESK.

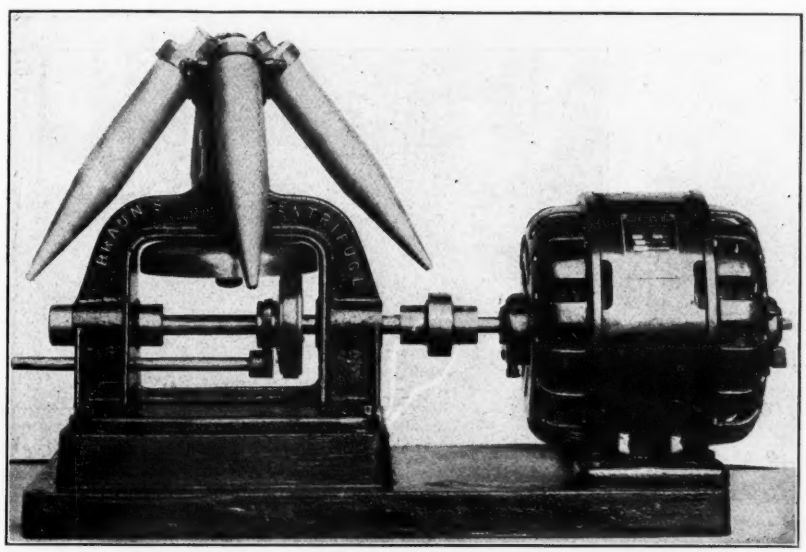
J. C. Freeman, 514 Monadnock Block, Chicago, Ill., is the western manager of sales for this device.

A Motor-Driven Centrifuge.

Mixtures of liquids of different specific gravities, or liquids containing sediments, may be separated in the course of time by the simple process of settling under the force of gravitation. But if the liquid is viscous, the difference in weight comparatively slight, or, as most frequently arises, the separation must be

carried out quickly, in order to make an analysis without delay, some greater force than that of gravitation must be called into play. This is most conveniently supplied by rapidly rotating the materials at a high speed, setting up a tremendous centrifugal force, many times that of gravity.

In the motor-driven "centrifuge" used for this kind of separation, and which, as shown in the accompanying illustration, consists of pivoted receptacles mounted to rotate about a vertical axis, the speed reaches more than 1,500 revolutions per minute. Under these conditions the pound mass of the centrifuge tube exerts a centrifugal pull of about 320 pounds, so that a sort of artificial gravitation is produced, 320 times as strong, and consequently 320 times as effective in separating mixtures, as the force of gravity. Since, when in use, the containers swing out horizontally, the centrifugal force on the material in their extreme tips is about twice that at the center of gravity of the containers. Accordingly, separations can be made with this apparatus in a very short time, while the adjustable-speed friction drive enables the tubes to be started gradually, and brought up to any desired speed.



A MOTOR-DRIVEN CENTRIFUGE.

The little motor shown, a quarter-horsepower, type A Westinghouse, is direct-connected to the friction-wheel shaft, which communicates its motion to the face-wheel, giving a range of 1,000 to 2,000 revolutions per minute. The glass container tubes are surrounded by water and enclosed in an aluminum case, furnishing a cushioning surface, which prevents breakage. The tubes contain 100 cubic centimetres, and are calibrated to tenths of a cubic centimetre, so that the results are easily and quickly read off. The motor-driven centrifuge is of recurring use in the laboratory, and is almost an absolute necessity in the separation of heavy, thick, viscous liquids, such as crude oils, etc. The Braun centrifuge is manufactured by F. W. Braun, Los Angeles, Cal.

"Electrocuted" Air for the Chicago Public Library.

Ever since the Chicago Public Library, at the corner of Michigan Avenue and Washington Street, Chicago, has been built, complaints have been constantly made about the musty flavor of the air in some of the rooms of this great institution. Especially was this the case in regard to the reading room and patents department in the north end of the building.

It appears that the library is a favorite resort for many of the unfortunates who are out of employment, and who, being without the means to keep themselves in as sanitary a condition as is compatible with public decency, consciously or unconsciously emit an odor from their persons which, to say the least, is decidedly annoying to the better-class element which naturally desires to share the benefit of the library; and this, notwithstanding the excellent system of purified air-ventilation which is installed in the building.

So great had this nuisance become that Dr. W. A. Evans, the Health Commissioner of Chicago, decided that something must be done to mitigate this state of affairs. Accordingly, Arthur D. Lord, manager of the National Air Filter Company, of Chicago, was requested to consult with the engineers of the library with a view to installing an ozonizing apparatus, to be used in conjunction with the ventilating devices, which should renovate the air and charge it with sufficient ozone to kill all the objectionable odors in the rooms mentioned. As a result a special ozonizer was designed by Samuel C. Shaffner and S. T. Hutton, electrical engineers, which has proved even a greater success than was thought possible.

The apparatus is located in the basement of the building, and the principles of design are similar to those of the ozonizer described in our issue of June 26 last. Direct current at 110 volts is taken from the mains into a "Peerless" rotary converter regulated by a Cutler-Hammer starting box. This in conjunction with a pressure-regulating apparatus converts it into alternating current at 120 volts which is then stepped up to about 8,000 volts by a special transformer. The high-tension secondary current discharges with a violet-colored silent cold discharge between the plates of the ozonizer through which air is sucked into the air-duct uptake leading from the ventilating apparatus to the floors above. R. G. Allison, one of the library engineers, has facetiously put a placard opposite the ozonizer, which reads "Danger, 66,000,000 volts!" Mr. Allison explained that he would have added a few more zeros, only that he ran out of ciphers in his stencil box.

The air in passing between the plates is, to use Mr. Shaffner's humorous expression, completely "electrocuted;" that is to say, every living organism is annihilated and a large part of the air is converted into ozone, which mixes with the air in the uptake and dissipates any kind of odor with which it comes into contact.

The air drawn into the building by the electrically-driven suction pump is washed and dried before being ozonized. The washing is accomplished by driving it through sprays of pure water and drying is effected by forcing it through a series of baffle plates with upturned edges so as to throw off the moisture by a sort of centrifugal action.

Mr. Allison told our representative that at first he was afraid that the air should be washed after being ozonized on account of the nitrous fumes which are usually generated by electric ozonizing apparatus, but a series of tests convinced him that

the Shaffner ozonizer generated practically no nitrogenous compounds, and that the present method of installation was the best that could be devised. He further told of a friend of his, a Grand Army man, troubled with blood spitting, who came frequently to the library on the advice of his physician to inhale the ozonized air, and who consequently was rapidly being cured of his complaint.

C. R. Barnes, superintendent of the patents department of the library, also gave evidence of the health-giving properties of the ozonized air. Mr. Barnes stated that since the installation of the ozonizer, his catarrh, which he had come to regard as chronic, had entirely disappeared.

A visit to the reading room proved the efficacy of the new apparatus, the room no longer smelling like a cheap lodging house, but approximating the breeziness of the hurricane deck of a liner in mid ocean. Mr. Allison stated that upward of 1,200,000 cubic feet of ozonized air were passed through the room and the whole of the air renewed upward of five times, every hour.

Thanks are due to R. G. Allison, J. Reitz, engineers, and C. R. Barnes, patents department, all of the Chicago Public Library, for their courtesy in giving the details of the new installation.

An Electric-Driven Well Driller.

In order to satisfy the demand for a portable blast-hole drilling machine operated by an electric motor instead of boiler and engine, the Keystone Driller Company, Beaver Falls, Pa., has designed the motor-driven drill shown in the accompanying illustrations.

The Keystone electric-driven machine, recently tried out at the James and A. C. O'Laughlin quarry, at Belwood, near Chicago, was equipped with a ten-horsepower motor placed over the rear truck of the machine and belted to the back-geared drilling mechanism.

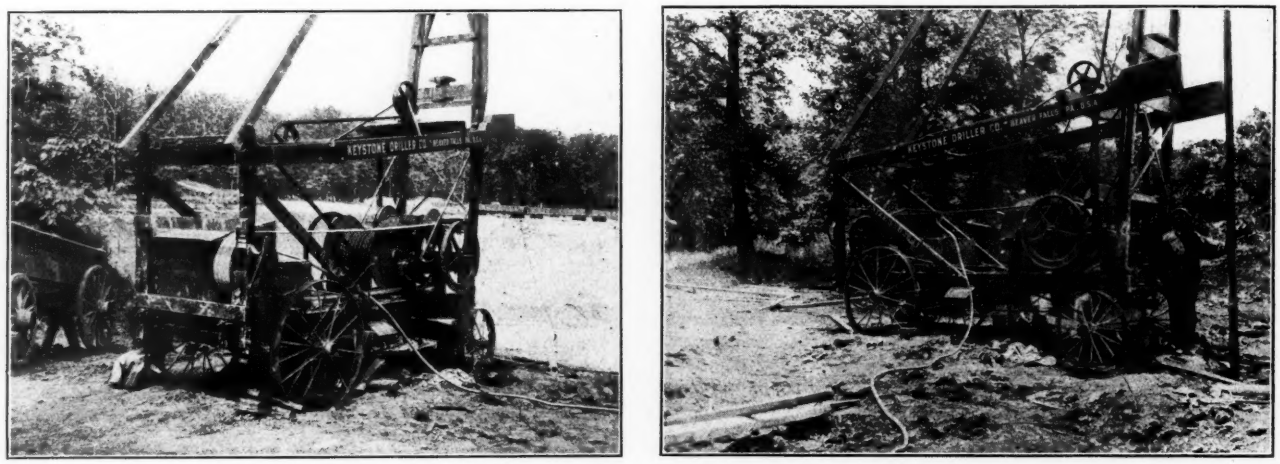
The controller box is placed at the drill operator's hand, in front, along with the other levers which regulate and control the various operations of drilling. The manipulation of the motor is very simple and the ordinary drill man will become thoroughly competent to handle it with a few minutes' instruction from the electrician. The laying of feed wires and other like adjustments will be looked after by the electrician in charge. One man can easily handle the machine without assistance, except when sand-pumping or moving the rig to a new hole. This is another saving in the cost of operating the steam machine, which requires the constant attention of a fireman, besides the driller.

The motor, drilling mechanism, derrick, etc., are all unified in a machine which is moved from hole to hole in its entirety. For short moves the derrick is not taken down.

At the full speed of the motor the drilling tools drop about sixty strokes per minute, which is ample in all cases to obtain the maximum drilling speed. As the hole becomes deeper or clogged with cuttings, before sand pumping, the rapidity of the stroke is gradually reduced to, say, fifty strokes per minute, in order that the cutting bit may deliver its blow with best effect. This can be done by reducing the speed of the motor.

The drilling tools used with this outfit comprise a stem, weighing about 1,000 pounds, drill bit of 150 pounds, and rope socket of about fifty pounds, or about 1,200 pounds in all. The bit cuts a five-and-five-eighths-inch hole and the stem is three-and-three-fourths inches in diameter and twenty-two feet long. The stroke being from thirty to thirty-six inches, a blow equivalent to about 3,000 to 3,500 foot-pounds can be obtained at each and every stroke.

The results of the test at the O'Laughlin quarry were as follows: The machine was set up at 5 p. m. Saturday, June 5 last, and began drilling. It was operated for one hour, during which nine feet were drilled in fairly hard limestone. From this time until the following Friday forenoon four sixty-six-foot holes, five-and-five-eighths inches in diameter, were drilled, the work being done without a hitch and without the necessity of any change whatever in the machine. In the following week four holes 105 feet in depth were drilled, the machine running ten hours a day in all cases. The record of a similar machine at Racine, Wis., in slightly harder rock was 900 feet in 200 hours, including all stops and delays in moving machine.



THE KEYSTONE ELECTRIC-DRIVEN WELL DRILLER.

This machine is built with gear hoist, capacity 500 feet, or with friction hoist, capacity 350 feet. The latter style is probably the better for quarry and cut drilling, where the tools are being constantly raised and lowered, as in tamping in a charge. The machine is also made with traction attachment (for self-propulsion) and, while it is impracticable to move it over great distances, on account of carrying along the electric feed wires, for short moves, from hole to hole, or from one side of the quarry to the other, it is a great advantage. The delay in waiting for a team of horses is saved, as well as the expense. For short moves the self-braced derrick is left standing.

Lifting Magnets.

Although the first commercial lifting magnet was made more than a dozen years ago it is only within the past two or three years that they have come to be regarded as indispensable adjuncts to plants handling large quantities of pig iron, scrap or heavy castings.

The Cutler-Hammer Clutch Company, Milwaukee, Wis., has placed on the market a lifting magnet possessing several distinctive features which are essential to good lifting-magnet design, a sectional view of which is shown in Fig. 1. The coil is made up of alternate layers of strap copper and asbestos ribbon. This makes it possible to crowd more copper into a given space and the asbestos insulation renders the magnet fireproof, permitting it to be worked at high temperatures without detrimental effects. The under face of the body of the magnet is protected by removable pole shoes on which the brunt of the wear and tear of the metal handled falls, and which can be renewed at small cost when worn out.

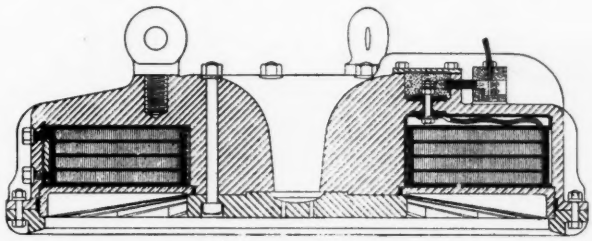


FIG. 1.—CROSS-SECTION OF LIFTING MAGNET SHOWING TERMINAL CONNECTIONS.

The coil-shield is constructed of manganese steel. This metal is quite suitable for the purpose, being able to withstand a great amount of hammering.

The single limitation to the lifting magnet's field of usefulness is that the objects to be handled shall possess magnetic properties. Wherever pig-iron, metal plates, tubes, rails, beams, scrap or heavy castings of iron or steel are handled, lifting magnets can be advantageously employed. The time saved due to the fact that hoisting tackle need not be adjusted to the object to be raised is worthy of consideration.

A Cutler-Hammer lifting magnet picking up axle butts from a scrap pile is shown in Fig. 2. Larger clusters than this are frequently picked up.

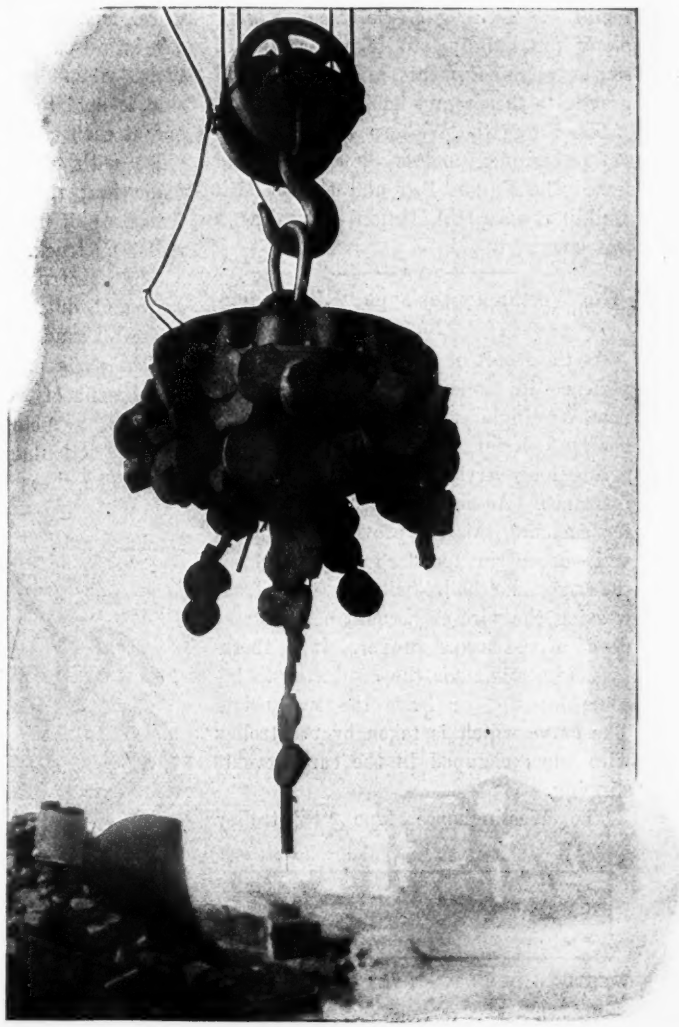
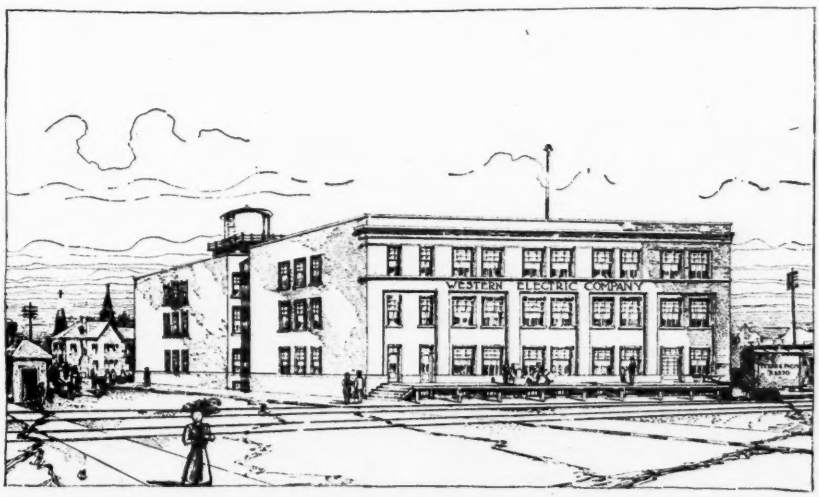


FIG. 2.—LIFTING MAGNET PICKING UP AXLE BUTTS.

The Dallas House of the Western Electric Company.

The Dallas branch of the Western Electric Company recently moved into its new quarters in its own building at Pacific and Evay streets. The new house is a three-story and full-basement model structure, equipped with a 25,000-gallon tank to supply the fire protection apparatus.



WESTERN ELECTRIC COMPANY'S BRANCH AT DALLAS, TEX.

The Western Electric Company has been in Dallas two years, but during this time business has increased to such an extent that the old quarters were found inadequate, and as a result this new structure, costing approximately $100,000, has been built. In this building, which acts as a storehouse and contains the offices of the company, is also included a large repair shop, to take care of the ordinary repairs of the apparatus handled by the company. This is one of the main features of the Dallas house, as they will give the same service as is given in the other large houses of the company.

Employment will be given to about 125 men, which is an increase of fifty per cent over those formerly employed by the company.

One of the main points in the building of the new warehouse has been the convenient location of the transportation

facilities. There is ample trackage lying along the building to take care of all southwestern shipments, and this will add greatly to the prompt handling of orders.

Heretofore the Western Electric Company occupied offices downtown and leased the Fulton Bag and Cotton Mill Building, near the Union Depot, as a warehouse.

The Westinghouse Type "R" Trolley Ear.

As the result of extensive practical experience in trolley-line construction the new Westinghouse type "R" trolley ear has been designed with a special view to giving long service and satisfactory performance. As shown by the accompanying sketches, this ear provides a straight and smooth run for the trolley wheel; at the same time the latter is prevented from wearing the wire on account of the great depth of the bronze runner. It is, therefore, impossible for the conductor to become loosened or leave the suspension. The curve which is taken by the trolley wire when clamped in the ear prevents slipping.

The Westinghouse type "R" trolley

WESTINGHOUSE TYPE "R" TROLLEY EAR.

ear is said to last from five to six times as long as any clinch ear, and its wearing part is renewable at small cost. The malleable iron yoke is attached permanently to the stud of the suspension, while the bronze runner is readily removable to be reversed or renewed. The ear may be quickly attached without soldering or

TYPE "R" TROLLEY EAR—OPENED.

hammering, and may also be used to feed into the trolley wire. The Westinghouse type "R" trolley ear is made in a number of sizes to take the standard sizes of round trolley conductor, and is equally suitable for installation on tangents and moderate curves.

The Bradshaw Car Skid.

The skid, illustrated herewith, is for the purpose of providing a quick and reliable means of avoiding delay in the schedule caused by a car with broken wheel, axle or crippled truck. A crippled car is raised from the track but three inches when the skid is in position. The skid is held to the truck by four chains, one at each corner. The chains are provided with turnbuckles. The skid is so made that the wheels may rest in the frame or it may bear directly on the motor or truck.

The construction is such as to allow easy and quick attachment to any car under all conditions. The position of the broken parts makes no difference to the attachment of the skid. The shoes are made of a metal composition which is nearly frictionless and will not wear the rail. The shoes weigh forty-five pounds

THE BRADSHAW CAR SKID.

each. With a twenty-eight-ton car the shoes will give from fifty to seventy-five miles service under the most severe conditions. Only the shoes need to be replaced. The rest of the skid will last indefinitely.

Crippled cars equipped with the Bradshaw car skid have passed around curves of forty-foot radius roads at full speed test. The skid will safely carry the heaviest car, at any speed, forward or backward, with little difference in the motion of the car. With this device crippled cars go in under their own power.

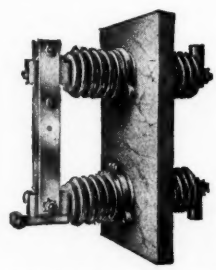
It is advisable to have several skids, each located at a convenient point on the line, so as to be accessible in case of accident. The skid may be carried on the platform of any car. When word is received that a car is crippled on the line the skid can be put on any car that is handy and quickly run to the broken-down car. Four men can handle it. The car may be raised by jacks and the skid slid under the damaged truck. The center of the shoe should be directly in the center of the axle bearing. After the car is lowered on the skid the chains may be hooked in place and the turnbuckles set. It is adjustable to any single or double-truck car, on horse, steam or electric railroads.

The Bradshaw car skid is manufactured by the Lord Electric Company, New York, N. Y.

Condit Disconnecting Switches.

It has grown to be a practice in all high-tension stations to equip the high-tension apparatus, such as transformers, oil switches, etc., with an air-break switch whose functions are not to open the circuit under load, but to isolate the apparatus from the line, so that it is absolutely safe to handle.

This practice has called for the development of a line of switches known as disconnecting switches. The insulation on these switches must be ample, the break distance



CONDIT DISCONNECTING SWITCH.

large, in order to form sufficient air space between the terminals where the switches open, and the switch must be comparatively inexpensive and at the same time rugged and substantial.

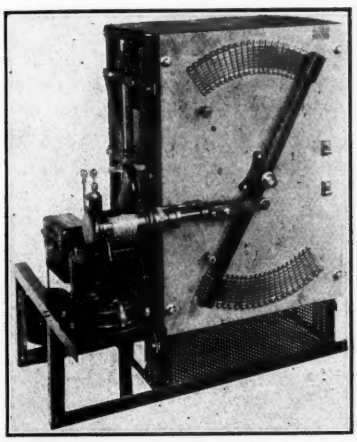
The switch shown in the accompanying illustration is made by the Condit Electrical Manufacturing Company and possesses these features. The insulators are of corrugated porcelain and are so arranged that the switches can easily be made either back connected, front connected or half back connected and half front connected. The blades and clips are double and the construction allows the use of heavy copper and at the same time gives spring enough to make a good contact.

The switches are all provided with a stop, as clearly shown, to hold the switch at right angles when open and with a spring catch which prevents the switch from falling open, even when mounted upside down.

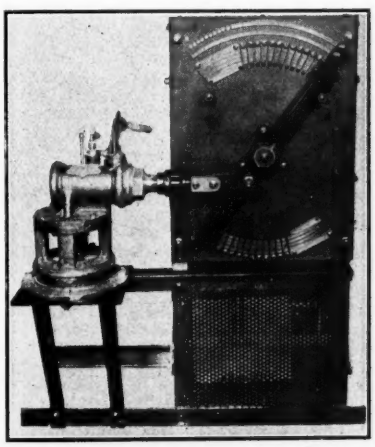
These switches are manufactured for various voltages and amperes up to and including 1,200 amperes and 40,000 volts.

Pressure-Controlled Motor-Speed Regulators.

In the electric pumping of fluids it is often desired to keep the pump in continuous operation, but at variable speed so as to produce a constant pressure regardless of the rate of discharge. This requires that there shall be provided in the circuit of the motor driving the pump or blower an automatic regulator of its speed that is capable of being controlled by slight variations in the pressure of the liquid or gas that is being pumped. A type of regulator designed to meet these difficult requirements has been placed on the market and found to give excellent service.



VIEW OF SPEED REGULATOR ARRANGED FOR REGULATION OF ARMATURE ONLY.



VIEW OF SPEED REGULATOR ARRANGED FOR BOTH ARMATURE AND SHUNT FIELD REGULATION.

Particular application of these speed regulators has been made for motors operating boiler-feed pumps, and mechanical draft blowers in connection with stokers. In each of these cases the steam pressure of the boiler is maintained practically constant. The operation of gas-pressure blowers has also been successfully carried out. In fact, these regulators are adaptable to any service where the pressure of the air, gas, water or other fluid is kept above twenty-five pounds per square inch.

For controlling direct-current motors the equipment consists of a standard rheostat with no-voltage release and the special speed regulator referred to. For lowering the speed below normal, resistance is inserted in the armature circuit step by step. To raise the speed of shunt or compound motors above normal, the field is weakened by the insertion of resistance in the shunt-field circuit. By either or both these methods a wide range of speed control is secured.

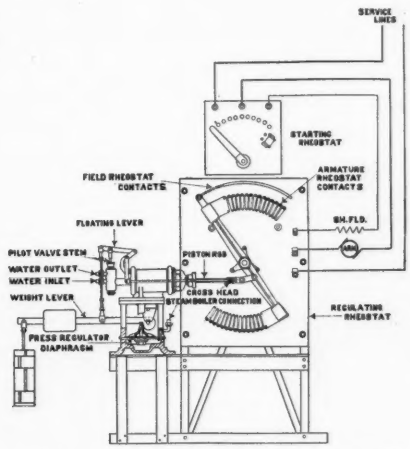


DIAGRAM OF SPEED REGULATOR FOR DIRECT-CURRENT MOTOR.

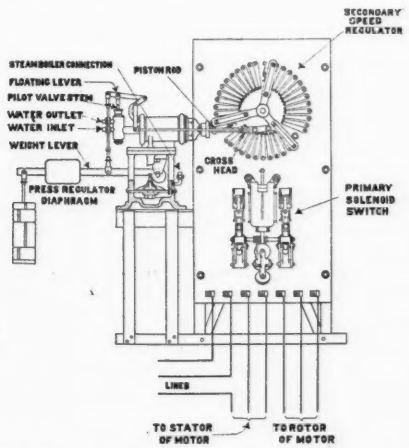


DIAGRAM OF SPEED REGULATOR FOR THREE-PHASE ALTERNATING-CURRENT MOTOR.

For alternating-current induction motors it is customary to provide a solenoid switch in the primary or stator circuit and a speed-regulating rheostat in the secondary or rotor circuit. Diagrams of the direct-current and alternating-current control equipments and photographs of the two chief classes of the former are reproduced herewith. These illustrations also show the principal features of the pressure-controlled mechanism that governs the speed-regulating rheostat arm, as applied to a forced-draft system.

The rheostat arm is actuated by the piston of a hydraulic cylinder, the admission and exhaust port valves of which are in turn controlled by the movement of a pressure-regulator diaphragm, one side of which is subjected to the boiler pressure. The normal boiler pressure on the under side of the diaphragm is balanced by a weighted lever bearing upon the top of the diaphragm in such a way that this lever will rise or fall as the boiler pressure rises above or falls below the normal pressure for which the lever is counterbalanced. This up-and-down movement of the lever operates a pilot valve controlling the admission of water to the hydraulic cylinder shown to the left of the slate panel and, due to this pressure, the piston of the cylinder is moved back and forth operating in turn the double-ended rheostat arm which rides over the contact segments of the rheostat mounted on the slate slab.

In the particular application referred to, when the boiler pressure is low, the arm is in the full-speed position. As the pressure rises the resistance in the field circuit is first cut out, assuming a direct-current shunt motor to be used, and then the armature resistance cut in, thus gradually slowing down the motor. Upon a decrease of pressure the reverse cycle of operations is carried out. By means of an ingenious contrivance the cutting in or out of resistance proceeds in a step-by-step manner, thus preventing violent changes in motor speed and their accompanying wear and tear of the machinery and sudden current fluctuations in the supply circuit. Although the cylinder at the left side of the panel is usually a hydraulic cylinder, it is not necessarily so, for when water pressure is not available the same results can be obtained by connection with a compressed-air tank or similar device.

In the design of these speed regulators, the extended experience of their manufacturer, the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., was productive in arranging their details so as to make a rugged construction capable of severe and continuous service without arcing or overheating. These regulators, moreover, require practically no attention except occasional dusting, and their performance has been exceptionally successful.

Adjustable Speed Commutation Pole Motors.

The Triumph Electric Company, Cincinnati, Ohio, is placing on the market adjustable speed commutation pole motors which are particularly suitable for machine tool drive.

The construction is practically identical with that of the constant speed motors, with the exception that the commutation poles are placed midway between the main field poles and are firmly bolted to the field yoke. These poles are formed of the best quality of wrought iron obtainable and are carefully wound and insulated.

The coils are in series with the armature circuit, so that the strength of these poles depends upon the load on the motor, and is therefore proportional to the armature reaction. This is true irrespective of the direction of rotation, so that the points of commutation are always in a field of such strength that sparkless commutation at all loads and all speed variations is obtained.

Another commendable feature in these motors is the heavy overload capacity which is possible on account of the peculiar mechanical construction of the machines.

Fig. 1 is a view of the Triumph adjustable speed commutation pole motor, and Fig. 2 shows one with the front bracket removed, revealing the commutation or auxiliary poles.

These motors are built in all standard sizes.

FIG. 1.—TRIUMPH COMMUTATION POLE MOTOR.

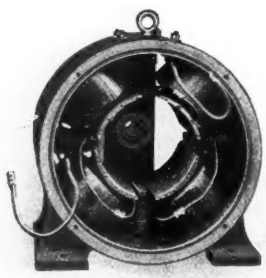


FIG. 2.—TRIUMPH MOTOR WITH BRACKET REMOVED.

Westinghouse Electric Company.

A representative of the Westinghouse Electric and Manufacturing Company says: "We have at the present time between 10,000 and 11,000 employes on our payrolls, which compares with about 6,000 at the low point of the depression.

"Gross business is now running at the rate of $2,500,000 per month, or $30,000,000 per annum, which is an increase of 130 per cent from the low. July gross was at the rate of $3,000,000 per month, but it is hardly fair to accept this as the monthly average. July was an exceedingly good month for us, every one of our commercial departments having shown a substantially larger gross amount of business than any previous month this year. There was but a single order that might be called out of the ordinary in point of size.

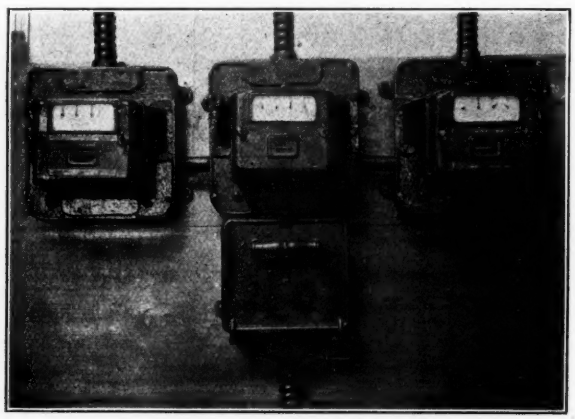
"August is a vacation period, and we do not expect business for the current month to be quite as large as last. There is, however, every indication that our July gross will be greatly exceeded in the coming fall months."

A favorable feature of Westinghouse Electric operations is the excellent results the foreign companies are making.

The Hemere Combined Meter Panel and Cut-Out.

A number of important installations of the Hemere combined meter panel and cut-out have been made recently that have demonstrated the utility and marked advantages of this appliance. It has been adopted by several central stations for use in placing meters in buildings where there are a number of consumers.

The service wires enter through a single cut-out from below and then connect with a set of horizontal busbars on the meter panel, to which any desired number of meters can be joined. This is shown by the illustration herewith. In an article describing this appliance in our issue of August 7, this illustration, through an unfortunate error of the printers, was shown upside down.



HEMERE COMBINED METER PANEL.

William Charnley, of 59 Leonard Street, New York city, who supplies this Hemere specialty, states that the absolute security against tampering and fire, as well as the speed with which it can be installed and its neatness when finished, are points that have particularly appealed to the purchasers of the device.

Infringement of Patent Suit.

The General Electric Company last week instituted two suits in the Federal Circuit Court at Toledo, Ohio, against the Yost Manufacturing Company, also of Toledo, alleging infringement of patent. The plaintiff company claims that it has been manufacturing a certain patent lamp socket invented by Howard R. Sargent and Julius C. Tournier, both of Schenectady, N. Y., and that the plaintiff has secured the patent rights from the inventors. The petition asks for an injunction restraining the defendant from any further infringement of the patent and for damages. H.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, AUGUST 14.—A point of great interest to contractors came before the courts here this week. The Derby Corporation entered into a contract with a particular firm for the construction of tramways, and the borough engineer was appointed arbitrator to deal with any matters upon which disputes might arise. While it is true that the contractors agreed to this latter proceeding, yet they had little option, for it was decreed by the corporation, and the only alternative was to lose the contract, although it is a practice now generally discarded except on the part of municipal bodies. The majority of independent consulting engineers are greatly averse to the practice. In the construction of the Derby tramways considerable delays occurred which left the contractors liable for a large sum of money in the way of fines. The contractors, however, claimed that the delay in completion was in some measure due to the actions of the borough engineers, and that, therefore, as the points had to be arbitrated upon, the clause constituting the borough engineer arbitrator was an unfair one, as he was not a fit person to decide whether he himself had been unreasonable in his dealings with the contractors. The sum in fines being a large one, the contractors had no option but to try to secure the setting aside of the arbitration clause in the contract as a matter of common sense, and in this it is pleasing to note that the courts have taken this view. It may be that this decision will have the effect of breaking down a method of dealing with contractors on the part of municipalities which is extremely unfair and creates a position open to abuse.

The latest half-yearly railway reports show that the directors of these undertakings are taking a different view of tramway completion to that formerly adopted. It is now generally conceded that it is futile to attempt to regain the purely local traffic which has been abstracted from the railways by the trams, as the latter give facilities for this traffic which railways do not, and that the railway companies' energies will be better employed in improving the service in order to induce more people to live greater distances out, beyond the sphere of influence of the trams. Very opposite opinions are also held by different railway chairmen as to the best method of proceeding with electrification of the existing steam railways. The Southeastern and Chatham Company's chairman disagrees with the London, Brighton and South Coast Company's policy of dealing with their line in this matter piecemeal, and predicts that the London County Council tramway officials will concentrate all their efforts upon the single-phase line about to be opened, in an endeavor to render the experiment unsuccessful commercially. This is rather a flight of the imagination, but it is sufficient to show the obstacles which electrical engineers in Great Britain have to overcome before any considerable extension of steam-railway electrification will take place here. Fare-cutting seems to be the policy adopted by railway companies just now for minimizing the effect of tramway competition.

The Railless Electric Traction Company will shortly be putting into operation an experimental installation of its electric trolley omnibuses on the outskirts of London, a large British-made vehicle being now on the spot. So far as this country is concerned, however, there is not much likelihood of any corporation adopting it for another twelve months, owing to the necessity for obtaining Parliamentary powers. For some unexplained reason, the ratepayers of Liverpool and Manchester, at the beginning of the present session of Parliament, insisted upon powers to adopt the system being withdrawn from bills which were then being promoted.

As the result of a further extension this week of the London County Council tramways, it is now possible to travel by tramcar from the extreme south of the Greater London area to the extreme north, a distance of twenty-two miles. To do this, a passenger travels over the lines of two municipalities and one company.

The Yorkshire Electric Power Company, a feature of whose power station is the first Curtis turbine installed in this country, is making rapid financial progress. For the half-year to June last, the net profit was $5,350, compared with $1,800 for the corresponding period of the previous year, and a heavy loss in the year before that. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 15.—An extensive plant has been erected in France for the manufacture of carbide and also for cyanamide, the new fertilizing product which is obtained by treating carbide with nitrogen. The two factories for these products are located at Notre Dame de Brancon, and they now employ a large amount of current. This, as we already noted, is brought to the spot from two hydraulic plants which lie at some distance off. The first of the hydraulic plants utilizes 3,000 horsepower from the torrent of Eau Rousse, while the second station is situated on the St. Jean torrent. As to the first of these plants, it uses a 230-metre head of water, with a penstock of 1,382 metres length. In the station are seven turbines of the Duvillard type, five of them being of 700-horsepower size and the others for the exciters. Thury alternators are coupled to the wheels. For the plant on the Belleville torrent there is used a tunnel 4,500 metres long leading to the settling basin, from which a penstock in ferro-concrete leads for 100 metres to the turbines. At present there are used three turbines of 2,550 horsepower, these being coupled to Oerlikon alternators. Eventually the plant is to have seven groups of this size. The three-phase current is brought over a 15-000-volt power line for seven miles to the electrolytic plant, where transformers supply current at 150 volts.

The Municipal Council of Milan decided not long since to make a considerable increase in the system of underground conduits for electric lighting throughout the city, and has awarded the contract for this work to the Italian Edison Company.

In carrying out his reform upon the French postal, telegraph and telephone services, the new minister, M. Millerand, proposes to take a measure which is much needed, that is to separate these three services completely and thus avoid the confusion which now exists. This project will take some time to carry out, however. One of the first steps made by M. Millerand is to reinstate a number of the employes who had been revoked during the recent troubles. As most of their places have been taken meanwhile, this can only be done gradually and when there are vacancies in the service. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 21.—What is said to be the first exhaust-steam-turbine in Canada is shortly to be erected in the Central Electric power house of the Dominion Coal Company, at Glace Bay, Nova Scotia. The plant will consist of one 1,000-kilowatt generating unit.

The grading for the electric railway from Cobalt to Haileybury, Ont., is about completed. The only delay now is that the Haileybury end, where, in deference to the representations of many citizens, the proposed line has been slightly altered.

The work of installing the electrical apparatus for turning the big railway swing bridge over the Welland Canal, just above Thorold, Ont., is proceeding without delay, and the bridge will very shortly be turned by electricity. Hitherto, it has taken three or four men to turn it, and it was an exceedingly slow process, electric cars being held up while boats passed the canal.

A complete change in the method of management of the Manitoba government telephones has been decided on, and will go into effect on September 1, when functional organization will be adopted. The arrangement is similar to that by which railway companies, as well as the Bell and other telephone companies, are governed, the business being divided into several independent departments. The province will be divided into districts, and the management will be under three heads: Commercial agents, superintendent of plant, and superintendent of service. One important new post will be created, that of general superintendent of plant for the province.

Rapid progress is being made with the work of erecting the steel towers for the transmission line from Niagara of the Ontario Hydroelectric Commission. So far, eighty-five towers have been put in place, and the work is proceeding at the rate of eight towers per day. The completed system will involve the longest transmission line in the world. With branches, it will be 297 miles in length, and will carry a current of 110,000 volts. The engineers have been able to allay the fears of farmers along the line, as to the element of risk involved in the stringing of high-potential wires over barns and out-buildings, and not a few of the farmers now anticipate the time when they will be able to use power from the government line to lighten farm labor.

A big and costly plant is to be erected on the property of the Cobalt Mines Power Company, of Cobalt, Ont. The

various manufacturers of mining machinery in Eastern Canada are now bidding on the supply and installation of the machinery. This plant is an electrical one, situate on the Matibitchewan River, about twenty-five miles from Cobalt. The company has the right to raise lakes feeding this power to the extent of forty feet. The company will have a head of 312 feet, which will be brought to the turbines through two steel tubes, five feet in diameter. The electrical installation will consist of four generators, 2,500 horsepower each, or 10,000 horsepower in all. It is proposed to keep one unit in reserve. There will be two transmission lines to Cobalt, to prevent any breakdown, and the right-of-way will be 135 feet. The current will be brought into camp at 44,000 volts, and the different mines will be fed at a voltage of 2,200. The plans call for the installation of one or two electrically driven air compressors, and they undertake to supply the mines with compressed air, as well as electrical power. The cost per horsepower will be about $50 per annum for a twenty-four-hour service. There will be two intake pipes, eight feet in diameter, and an outlet pipe of twenty-two feet. The blow-off pipe will be twelve inches in diameter. This plant is situated six-and-three-fourth miles south of the Temiskaming & Northern Ontario Railway, at Kerr Lake, at Ragged Chutes, on the Montreal River. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, AUGUST 22.—Lacombe, Alta., is now without electric light or power and there is little prospect of the evil being remedied this year. It is due to the washing out of the dam of the Blindman's River and Power Company a few days ago.

The Calgary Power and Transmission Company will shortly call for tenders for the erection of its power plant, forty-five miles west of Calgary, Alta., and the construction of the necessary transmission lines. Smith, Kerry & Chace, consulting engineers, Toronto, Ont., have the plans and will also supervise the work.

In answer to a question in the Winnipeg (Man.) City Council a few days ago, Alderman Willoughby stated that the civic power plant at Lac du Bonnet, now being constructed at a cost of $3,500,000, will be in operation by 1912.

The City Council at Ladysmith, B. C., has awarded a contract for a complete municipal electric-light and power plant to the Canadian Westinghouse Company. George M. Turner is city electrical engineer.

The Winnipeg Electric Street Railway Company, of Winnipeg, Man., has completed plans for a nine-track car barn, subpower station and freight sheds to cost over $100,000. They will be erected in the north end of the city. Wilford Phillips, general superintendent.

The Rainy River Radial Railroad Company is applying for incorporation under Dominion laws to operate an electric street-railway system in and around Fort Francis, Ont. Among the lines planned is one to the international boundary.

Plans are being considered by the City Council at Regina, Sask., for a municipal electric street railway to be built in that city and it is expected tenders for construction will be called before the end of the month. Address Alderman Peverett.

That the municipal street railway system at Calgary, Alta., is a paying proposition, is evidenced by the report for July, which shows net profits of $3,995.36 after expenses amounting to $1,398.41 had been paid. Several extensions are planned by the Council.

The Manitoba Government Telephone Commission, with headquarters at Winnipeg, Man., has decided to divide the province up into districts. Each district will be under the direct responsibility of a commercial agent, superintendent of plant and superintendent of service. These officials will be under similar officials for the whole province, who will be responsible to the commission. H. S. Patterson is chairman of the commission.

Before the end of the year officials of the Canadian Pacific Railroad will go over the Columbia & Western branch with a view to ascertaining the feasibility of operating it by electricity. At Bonnington Falls there is 35,000 electrical horsepower available and several other undeveloped powers along the route of the line. Lorne A. Campbell, Nelson, B. C., is in charge.

The International Railway and Development Company, of New Westminster, B. C., has given official notice that it is about to construct an electric street-railway system in the Municipality of Sutton. Bowser, Reid & Wallbridge, Vancouver, B. C., are attorneys for the company. R.

LIGHTING AND POWER.

(Special Correspondence.)

RUSSELL, KAN.—A $65,000 bond issue has been voted for waterworks and electric-light systems.

MELROSE, CAL.—An electric-light district has been formed here in conformity with the new state law.

PORTALES, M. M.—The United States Sugar and Land Company, of Garden City, Kan., has contracted with farmers about this place to construct a power plant near this place to furnish power for pumping water sufficient to irrigate 12,000 acres of land.

BENTON, ARK.—The Atkinson Water Power Company has been organized and will put in a power plant.

COUNCIL GROVE, KAN.—An electric-light franchise has been granted to H. H. Sparks, of Junction City, Kan.

LUBBOCK, TEX.—The Lubbock Light, Ice and Power Company has been organized with a capital stock of $25,000.

ST. MARIES, IDAHO—The City Council has awarded to G. H. Jay the electric-lighting franchise recently applied for by him.

ROCKY MOUNT, N. C.—The new city electric and pumping plant has been completed and power is now available for all uses in the town. L.

ALBEMARLE, N. C.—An issue of $27,000 municipal bonds for lights, water, etc., has been carried by a large majority in a recent election in the town. L.

YUMA, ARIZ.—A bond election will soon be held here for the purpose of voting on a bond issue of $200,000 for an electric-light plant and a water plant.

UNION, ORE.—A special election has been called for the purpose of voting on the issuing of bonds for the erection of a municipal electric-lighting plant.

TUCSON, ARIZ.—A. M. Conrad, of the Sonora Copper Company, is preparing to install an electric power plant and an aerial tramway in the Caracahui Mountains, in Northern Mexico.

EVERETT, WASH.—J. E. Wickstrom, of Seattle, has bought the Snohomish Electric Light and Water Company, of this place, and is planning to partially reconstruct the distributing system.

COLUMBIA CITY, IND.—The City Council is asking for bids for the installation of two 350-horsepower vertical water-tube boilers, with steel stacks, in the electric-light plant. F. T. Schultz, superintendent. S.

TACOMA, WASH.—The Northwestern Electric Company has been incorporated here, with a capital stock of $300,000, by F. H. Lauzon, E. L. Hollingstead, H. D. Nowlin, F. McFarland and J. P. Covert.

BOSTON, MASS.—The gas commissioners have approved the sale of the Cohasset Electric Light Company to the Electric Light and Power Company, of Abington and Rockland. The price paid for the property is $18,000.

SAND POINT, IDAHO—The Northern Idaho and Montana Power Company has begun construction on its power line from Sand Point to Newport and other towns. It is given out that the expenditures will reach $2,000,000.

BRECKENRIDGE, COLO.—W. B. LeWald, manager of the New Pennsylvania Mines Company, and the Colorado-Toledo Mining Company, has announced that he is having plans drawn for a new 100-ton concentrating mill for the Colorado-Toledo mine, at Montezuma.

PRESCOTT, ARIZ.—Attorney E. S. Clark has been in Chicago on business connected with the issuing of bonds for the construction of the proposed plant for the Pacific Water Power Company, of which E. H. Meek of this city is president and principal promoter.

SEATTLE, WASH.—The management of the Alaska-Yukon-Pacific Exposition at this place has been notified of the appropriation by Congress of $30,000 for the completion of the illumination of the four United States government buildings on the exposition grounds.

ESPANOLA, N. M.—The Espanola Milling and Elevator Company is preparing to install a 2,000-horsepower electric plant. The company has been incorporated, with a capital stock of $25,000, by Geo. Bond, of Trinidad, Colo., Frank Bond, of Espanola, and others.

LONG BEACH, CAL.—The Harbor Electric Light and Power Company has been incorporated here, with a capital stock of $250,000, by S. N. Butters, A. C. Green and J. R. Mason. The incorporators have a site near Long Beach, and will develop electric power for lighting purposes.

SAVANNAH, GA.—The Twin City Power Company, holding a franchise to build a dam and construct an electric plant on the Savannah River, at Augusta, has applied to the city of Savannah and Mayor Tiedeman for a franchise to sell power in Savannah. The power company was represented by Judge Joseph R. Lamar and two officers of the Twin City Company. It is expected that similar franchises will be asked of numerous other cities and towns in the state of Georgia. L.

PETERSBURG, VA.—As required by law, the charter of the newly organized or reorganized properties, under the title of the Virginia Railway and Power Company, having been granted, and a mortgage deed given in favor of the Equitable Trust Company, of New York, to secure a fifteen million dollar first and refunding

mortgage bond issue of five per cent gold bonds, this mortgage has been filed with the court here to be copied. It is a lengthy manuscript of some 125 pages of printed matter.

SUNBURY, PA.—The Edison Company, of this city, has closed a deal with the Eyre-Shoemaker contractors to furnish sixty arc lights and 500 incandescent lights on their big job in building the classification yards at Northumberland.

PORTLAND, ME.—The work on the new hydroelectric power station in the Brunswick cove, which has been built for the Brunswick Electric Light and Power Company, is now practically complete. The machinery is nearly installed and there is but little work still to be done.

RENO, NEV.—C. D. Galvin and F. H. Hall, of San Francisco, have bought out the power rights of Hayden Henderson and J. J. Hylton on the South Fork of the Humboldt River, in this state. The new owners will develop power for the use of the mining companies in and about Ely.

INDIANAPOLIS, IND.—The Merchants' Heat and Light Company will build a substation on Susquehanna Street. This and other improvements will cost nearly $1,000,000. The substation will be equipped with high-priced machines and electrical apparatus. Edward L. McKee is president. S.

INDIANAPOLIS, IND.—A 7,500-horsepower turbine, the largest in the state, is being installed in the Mill Street station of the Indianapolis Light and Heat Company. The turbine was built in Schenectady, N. Y., and nearly two months will be required to set the monster piece of machinery. S.

DOUGLASVILLE, GA.—The sum of $10,000 electric-light bonds, issued by this town, have been purchased by the Central Bank and Trust Corporation of Atlanta, Ga., Carter & Gillespie, of Atlanta, having the contract to complete the work on the lighting system. The bonds were sold, it is reported, for considerably more than par value. L.

OAKLAND, CAL.—The power transmission franchise applied for by the Great Western Power Company will be offered for sale on September 15. A provision has been inserted in the franchise restricting the current carried over the lines to 15,000 volts. This does not apply to the main line leading to the company's substation at the head of Fourth Avenue.

WAKE FOREST, N. C.—The machinery outfit and the material for the power house has been ordered for the new power and lighting plant at Wake Forest, and the current is expected to be ready for use by the middle of September. The entire college plant also has been wired and will be furnished by electric current for lighting from the new power station. L.

GARDNER, MISS.—The annual meeting of the stockholders of the Gardner Electric Light Company was held last week. It was reported that the gross receipts of the company for the year were $42,000, an increase of $7,000 over any other year in the history of the company. These officers were elected: President, A. P. Derby; vice-pres., T. B. Dunn; treasurer, F. S. Whittemore.

RICHMOND, VA.—All of the contracts that have been awarded by the city for the various material, machinery, work, etc., for the new municipal lighting plant, up to this time, have been properly signed by the city representatives. All certified checks of bidders have been returned, amounting to $46,000, except that of the General Electric Company, which is expected to be reached in a short time. L.

HANFORD, WASH.—The Hanford Irrigation and Power Company has contracted with the Allis-Chalmers Company for a 1,000-horsepower vertical triplex open-flume turbine, an oil-pressure governor, a 900-kilowatt, sixty-cycle, 2,200-volt vertical alternator, three 400-kilowatt oil-filled water-cooled transformers and a switchboard, this being a duplication of the company's present installation at Priest Rapids.

RUTLAND, VT.—The first commercial power to be used by any company from the Connecticut River Power Company was used by the Estey Organ Company, of Brattleboro. The Estey company has a complete substation equipment and steps down the voltage from 19,000, at which it is transmitted to Brattleboro, from the power station to Vernon, to 550, the voltage at which the induction motors are run.

TACOMA, WASH.—F. C. Kelsey has completed surveys for the municipality's electric plant, and it is expected that contracts will be let before the end of the year. It is planned to develop 30,000 horsepower. The plans include the construction of a dam 300 feet long and forty-five feet high, the boring of a tunnel 10,000 feet long, and the laying across the river of a riveted steel pipe supported on concrete arches.

ATLANTIC CITY, N. J.—A huge new electric-light plant is to be erected by the Atlantic City Electric Company on the banks of the Thoroughfare, to more than double the capacity of the present plant on Kentucky Avenue, and furnish the city with capacity for maybe half a million more lights. At present the plans are not entirely perfected, but at least $150,000 is to be expended in the erection of a new supply station.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EL PASO, TEX.—The El Paso Electric Street Railway Company has secured concessions for its proposed extensions in Juarez.

OGDEN, UTAH—The Salt Lake & Ogden Railway Company has been granted a franchise for an electric railway on Lincoln Avenue.

SAN DIEGO, CAL.—G. W. Purcell, of the San Diego & Escondido Railway Company, announces that he has secured the entire right-of-way for the company's line between this place and San Diego.

HARRISBURG, ORE.—A. Welch, president of the Willamette Valley Company, has announced that by October the Willamette Valley will be completely electrified, at a cost of more than $1,000,000.

PEORIA, ILL.—There will be no decision of the famous electrolysis case of the Peoria Water Company vs. the Peoria Railway Company before September, as all the federal courts are not in session before that time. V.

KINGMAN, IND.—Work is progressing rapidly in the construction of the Covington and Southeastern Traction Company's line through Fountain County. Steel rails are now arriving and track laying will be begun at once. S.

INDIANAPOLIS, IND.—The U. S. Express Company reports the largest Indiana business during July in the history of the company. The new lines it has on the trolley systems in Indiana are proving a handsome feeder, and the officials say traction lines are very profitable to the company. S.

COQUILLE, ORE.—It is announced here that a syndicate in Portland has raised $3,000,000, and an eastern man has another million, which they propose to put into an electric road between Coos Bay and Portland, and they will start work inside of three months. J. P. Allen, of Tacoma, Wash., is interested.

SOUTH BEND, IND.—A seven-car trolley train was successfully operated on the South Shore traction line, between this city and Michigan City, August 10. The train was run to the city limits in two sections, when they were coupled together and made the trip without any mishap. The train made the usual number of stops on fast time. S.

MORRIS, ILL.—The Illinois Traction Company has had surveys run between Morris and Joliet and also to Yorkville, Ill., and as soon as the officials have decided which route will be used the work of construction will be started on that part of the lines, which means that the Traction Company is surely heading toward the city of Chicago. V.

SAN ANGELO, TEX.—The San Angelo Street Railway Company has been organized here. It was decided to place the authorized capital stock at $100,000. A board of directors was elected, and everything is being placed in readiness for the opening of street-car service in time for the fall fair. Eight new cars of the latest pattern are to be ordered at once.

BRUNSWICK, GA.—The extended franchise of the City and Suburban Railway Company expiring on September 26, it is estimated that a minimum of five miles of tracks will have been completed by that date, and that the system will be in operation within sixty days' time. Work was begun on grading and tracklaying during the last ten days in June, and is being pushed with vigor. L.

ATLANTA, GA.—The possibility of effecting a merger of the local street-railway system in Macon, and the Central Georgia Power Company, and the proposed interurban electric line from Atlanta to Macon, has been made possible by a bill which was passed by both houses of the Georgia Legislature during the closing days of that body, after a long delay and much effort on the part of those interested.

MACON, GA.—The Boyd bill, permitting the consolidation of the Atlanta-Macon interurban line, the Macon-Albany interurban line, and the Central Georgia Power Company, will undoubtedly mean the formation of a $10,000,000 merger of the three concerns named, with the local electric systems, the source of power being the Central Georgia Power Company, while the local lines of Macon will furnish all required routes of ingress and egress of that city. L.

PEORIA, ILL.—The Peoria Railway Terminal have been granted the franchise that they have so long sought through the city, giving them an entrance to the center of the city without having to pay a mileage fee to the Peoria Railway Company, over whose tracks they now are operating. Much difficulty has been experienced to secure a franchise that was satisfactory to all concerned, as it will operate over the only street that makes a good entrance to the city. The company will build up the street at once and comply with the terms of the ordinance, which makes it possible for other companies wishing to come to the city to rent the tracks at a reasonable price for their use. Much value is in

this grant, as the factories are along this street, which means that much freight can be had, as switching is allowed at stated times, which will make it possible for the company to handle carload shipments to the steam roads. In fact, the impression is that one or two of the steam roads will furnish the money to build the line up Washington Street. V.

COLORADO SPRINGS, COLO.—The Pike's Peak Cog road is to be double tracked and an electric third rail installed. C. W. Sells, general manager, is authority for the statement that these improvements will be made. They will cost approximately $750,000 and will be completed in time for next season's business. Already engineers are at work on the plans. Work on the reconstruction of the road will be begun at the end of the present season, or within two months.

SACRAMENTO, CAL.—Engineer Graham, of the Sierra-Sacramento Railway Company, has arrived here to take charge of the construction of that company's line from Sacramento to Lake Tahoe. The line will have a total length of 126½ miles. It is given out that General Manager Warner, of the company, who is now in Europe, will start for the United States on August 15, and that he will place orders for ties, rails and rolling stock as soon as he reaches Minneapolis.

EAST LIVERPOOL, OHIO—Plans for the newly-proposed electric road between Beaver Falls, Pa., and East Palestine and New Waterford, in Ohio, are now well under way, and work on the project is expected to be commenced within a few weeks. The proposed road will run from Beaver Falls to Columbiana via Darlington, East Palestine and New Waterford, and thus providing an outlet to the west over the Y. & S. and Stark Electric, and to the east over the Beaver Valley lines.

COLORADO SPRINGS, COLO.—To build a scenic electric railroad to the summit of Cheyenne Mountain, and thereby furnish another splendid tourist attraction to Colorado Springs, is the latest enterprise of a number of Colorado Springs business men. The road, which is to be three-and-one-quarter miles long, will run from the street-car loop at Broadmoor to the famous "Horn" on the top of Cheyenne Mountain. The estimated cost is $225,000, but subsequently an investment of $500,000 will be represented.

TOLEDO, OHIO—John Kilgour was elected to the presidency of the Toledo-Bowling Green & Southern Railway Company, at a meeting of the directors held in Cincinnati, last week. He succeeds George Kerper. The other officers elected are Henry L. Gibson, vice-president, and Albert J. Becht, secretary-treasurer. The directorate consists of these officers, together with S. C. Schenck and George E. Pomeroy, of Toledo; Baird L. Kilgour, George Kerper, F. C. Lawson and A. L. Andrews, of Cincinnati. H.

MARION, OHIO—George Whysall, general manager of the Columbus, Delaware & Marion Railroad, has been appointed receiver for the road by Judge Boston G. Young. Mr. Whysall immediately qualified and gave bond in the sum of $100,000. The action was brought by N. J. Catrow, treasurer of the company and president of the First National Bank of Miamisburg, Ohio, and is for the purpose of securing the payment of loans for which Catrow holds a collateral note signed by the Columbus, Delaware & Marion Railway Company, executed to the company's president, John G. Webb, and by him made over to Catrow. The note is for the sum of $372,381.81. It is dated June 1, 1907, and was due September 1, 1907.

BOSTON, MASS.—Several street-railway companies have been authorized by the Railroad Commission to issue new capital. The Boston & Northern and Old Colony Street Railway companies are authorized to issue, respectively, 5,883 and 4,042 shares of preferred stock, at $115, to supply working capital, the price of $115 having been fixed by directors in accordance with act of the recent Legislature. The Worcester Street Railway may issue $3,182,000 twenty-year five per cent bonds, proceeds to refund bonds previously issued, for taking over the Worcester & Marlboro, Worcester & Clinton and Leominster & Clinton companies. The Berkshire Street Railway Company is authorized to issue $190,000 bonds to pay floating indebtedness and cost of permanent additions.

FINDLAY, OHIO—The capital stock of the Toledo, Bowling Green and Southern Traction Company will be increased by the issue of $750,000 of preferred stock, entitled to dividends of five per cent per annum prior to and before the payment of any dividends upon the common stock of this company. The Toledo Urban & Interurban Railway will be purchased, payment for the same being $500,000 in five per cent bonds and $375,000 of the $750,000 preferred stock, thus giving to the bondholders of the Toledo Urban & Interurban Railway Company fifty per cent in bonds and thirty-seven-and-one-half per cent in preferred stock; the remaining $375,000 preferred stock to be given to the stockholders of the Toledo, Bowling Green & Southern Traction Company pro rata in exchange for common stock, i. e., each stockholder may surrender twenty-five per cent of his holding of common stock and receive in exchange a like number of shares of preferred stock. Bonds for $500,000 will be issued, which will be secured by a first mortgage of the property, to be acquired of the Toledo Urban & Interurban Railway Company, and a second mortgage on the Toledo, Bowling Green & Southern Traction Company.

DUBLIN, GA.—An application has been made to the mayor and Council of Dublin for a franchise to build a street railway in this city. The petition was presented by Hon. P. L. Wade and was signed by the following gentlemen: S. M. Kellam, W. W. Bush, A. W. Garrett, W. R. Brigham, A. P. Hilton, W. W. Robinson and P. L. Wade. The petitioners asked for a franchise for a period of twenty-five years, and asked for the use of certain streets exclusively. The promoters of the street railway are fully able to finance the enterprise, and if a reasonable franchise can be obtained, it is likely that work will begin just as soon as a charter has been obtained.

MT. VERNON, ILL.—It is announced that the erection of the proposed street-car plant here is assured. The business men and others have raised $100,000, after weeks of hard work, to purchase ground for the proposed plant. The proposition of the car company was that it would erect a fully equipped plant for the building of modern steel cars now coming into universal use on all railways, if ground sufficient for the plant was donated by the city. The ground has been donated. This plant means more to Mt. Vernon than anything that has ever happened in its history, business men declare. A plant will be erected costing not less than $800,000, and 2,000 men will find employment.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

REINBECK, IOWA—The local telephone plant is being rebuilt. C.

OGEMA, MINN.—A. L. Fredenburg of Waubun is about to install a telephone system here.

MALMO, NEB.—This city has voted bonds for the establishment of an electric-light plant.

COWLINGTON, OKLA.—The Cowlington-Spiro Telephone Company has been incorporated.

ALVA, OKLA.—The Valley Telephone Company has been incorporated with a capital of $3,000.

VALLEY, NEB.—Bonds to the amount of $17,000 have been voted here for an electric-light plant.

COUNCIL GROVE, KAN.—H. H. Sparks has been granted a franchise for an electric-light plant.

MUSKOGEE, OKLA.—L. H. McHenry has asked for a franchise to establish an electric-light plant.

BONDUEL, WIS.—The Bonduel Telephone Company has been incorporated with a capital stock of $5,000.

SAN DIEGO, TEXAS—The S. G. Smith Telephone Company has been organized with a capital of $11,000.

NEW RICHMOND, WIS.—The Wisconsin Telephone Company will rebuild its plant, at a cost of $2,000.

HOQUIAM, WASH.—The American District Telegraph Company has been granted a franchise in this place.

PRAIRIE GROVE, ARK.—The Prairie Grove Telephone Company has increased its capital from $6,000 to $12,000.

GLASGOW, MONT.—The Moore Telephone Company here is planning the erection of seventy-five miles of new line.

LITTLE ROCK, ARK.—B. F. Kendrick and others propose to buy the Little Rock Telephone Co. and rebuild the system.

ONTARIO, ORE.—The Ontario Independent Telephone Company has incorporated here for $10,000. Incorporators, Harry B. Granell and others.

SALINAS, CAL.—The county supervisors have granted to the Buena Vista Telephone Company a telephone franchise along the county highways.

WALLA WALLA, WASH.—According to Manager Van Hutte, of the local exchange, several thousand dollars will be expended in enlarging the telephone system.

HOQUIAM, WASH.—The Bell Telephone Company has accepted the franchise recently granted by the city, and will spend about $25,000 on the system here.

RENSSELAER, IND.—The Home Telephone Company has been incorporated to build and operate a telephone system in Jasper, White and Newton counties. The home office will be in Rensselaer. S.

BUENOS AIRES, ARGENTINA—As the representative of the River Plate Telegraph Company has offered to lay a direct cable from Buenos Aires to Europe via Tristan da Cunha free of all cost to Argentina, there appears to be little likelihood that the syndicate reported to have been formed in London with a

capital of $10,000,000 will obtain the desired concessions to carry out this same work, asking to be paid in five per cent government bonds.

LARSEN, WIS.—The Larsen Telephone Company has increased its capital stock from $5,000 to $10,000. Niels Jensen, president, and Louis Sorensen, secretary. C.

HAILEY, IDAHO—The application of C. E. Woods, forest supervisor, for permission to construct a telephone line along the county roads from Ketchum north, has been approved.

MONTROSE, COLO.—The Colorado Telephone Company will expend many thousands of dollars in the next few months in improvements, especially in the Uncompahgre Valley, and new extensions will be made.

BILLINGS, MONT.—The Bell Telephone Company has contracted with the Eastern Montana Independent Telephone Company for the construction of a line from Forsyth to Billings, to connect with the Bell lines here. C.

RUSHVILLE, IND.—The Rushville Gas, Light, Heat & Water Company has incorporated with a capital of $100,000 to supply the city of Rushville with the named commodities. Fred C. Carroll, John A. Walter and H. G. Walter are the directors. S.

GREAT FALLS, MONT.—The contract for the erection of the proposed exchange building of the Great Falls Automatic Telephone Company has been let to George Nelson, of Butte, Mont. The building will be erected at First Avenue, North, and Third Street and will cost $25,000. C.

EVANSVILLE, IND.—The contract for the lighting of this city for the next five years has been awarded to the Evansville Gas & Electric Light Company. Under the new contract the city will save a considerable sum as compared with the old contract for the lighting of the streets. S.

PERU, IND.—The Logansport & Wabash Valley Light Company and the American Gas & Light Company have merged and the latter company has shut down its plant and will get its supply from the former company's plant. G. M. Dally will manage both concerns or the merged business. S.

HILDESHEIM, GERMANY—The first automatic telephone exchange system to be used in this part of Germany has been installed at Hildesheim by the Imperial German Postoffice Department. It is believed that the German government will extend the use of automatic telephones, since they have been found very satisfactory.

PORT ARTHUR, TEXAS—This city will soon have as fine and modern telephone service as may be found anywhere. The South Texas Telephone Company has recently purchased a complete equipment of one of the largest electrical houses in the United States, and the new exchange will be in operation in about two months. The improvements will cost in the neighborhood of $15,000.

AMARILLO, TEX.—Negotiations whereby the Southwestern Telegraph and Telephone Company becomes the possessor of the long-distance lines between this city and Memphis, Tex., have been closed. The Northwest Texas Telephone Company is now engaged in an extension that will connect Lubbock, Tex., and Roswell, N. M. Amarillo is thus assured telephonic communication to all outside points when the improvements are made.

TECUMSEH, NEB.—The Crab Orchard Telephone Company, operating lines at Crab Orchard and out from that town, has sold its property to the Nebraska Telephone Company. The Crab Orchard Telephone Company was owned by O. A. Bailey, C. L. Rothell and Mrs. Etta Rothell. The transfer was made to Edgar M. Morsman, attorney for the Nebraska company, and A. D. Lane, special agent, both of Omaha, and to C. L. Rothell of the old Crab Orchard company. The consideration was $19,500, and the new management is now in charge.

BOLTON, CONN.—The Bolton and Coventry Telephone Company, one of the very few private telephone companies in Connecticut, voted at its annual meeting to incorporate under the joint stock act of Connecticut. The annual report showed that not only had the concern's business increased largely during the year, but the number of new instruments put in was constantly growing. The company is owned in a large measure by Dr. M. M. Maine and is a neighborhood affair grown into something more extensive and covering two towns now. It has no connection with the Southern New England Telephone Company.

ATLANTA, GA.—It is believed that the North Georgia Power Company will soon become a competitor for supplying power in the City of Atlanta, the company having filed a petition with the City Council asking for an extension of twelve months of its franchise to operate in Atlanta. The matter has been discussed between the company and the Council committee on electric and other roads. Already steel towers have been built up to the city limits from Gainesville and are supplying several large suburban manufacturing plants near the City of Atlanta. It is said that the company would have been in Atlanta before but for the stringent times of the fall and winter of 1907-08. L.

ELECTRICAL SECURITIES.

Toward the close of the week transactions on the stock exchange became quite narrow. The return of Mr. Harriman with the same optimistic views that he had when he went away did not particularly help prices, as there is anxiety over the state of his health and what he is going to do. Some industrial securities showed substantial gains, but it was a cross-saw market almost all week, with transactions confined almost exclusively to professionals. There are as yet no basic disturbing influences to a sound situation, no matter what form speculative rumors may take.

DIVIDENDS.

American Railways Company; the regular quarterly dividend of one-and-one-half per cent, payable September 15 to stock of record August 27. Books closed August 27, and reopen September 3.

General Electric Company; the regular quarterly dividend of $2 per share, payable October 15, to stock of record September 4.

NEW YORK.	Aug. 23.	Aug. 16.
Allis-Chalmers common	15¾	15⅛
Allis-Chalmers preferred	53¾	53⅞
Amalgamated Copper	85⅜	86⅛
American Tel. & Cable	80*	80*
American Tel. & Tel.	140	141⅝
Brooklyn Rapid Transit	81	80¼
General Electric	168	169⅝
Interborough-Metropolitan common	15	14½
Interborough-Metropolitan preferred	47½	47¾
Kings County Electric	130	135
Mackay Companies (Postal Telegraph and Cables) common	82	81
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74½
Manhattan Elevated	141	143½
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	142	143
U. S. Steel common	76¾	78½
U. S. Steel preferred	125	127
Western Union	73½	74
Westinghouse common	86¼	87⅛
Westinghouse preferred	120	120

*Last price quoted.

BOSTON.	Aug. 23.	Aug. 16.
American Tel. & Tel.	140	141⅝
Edison Elec. Illuminating	252	254
General Electric	168	169¾
Massachusetts Electric common	14	13
Massachusetts Electric preferred	73½	73
New England Telephone	137	137
Western Tel. & Tel. common	11	11⅛
Western Tel. & Tel. preferred	89½	90

PHILADELPHIA.	Aug. 23.	Aug. 16.
American Railways	46	45⅞
Electric Company of America	12⅜	12¼
Electric Storage Battery common	60½	61
Electric Storage Battery preferred	60½	61
Philadelphia Electric (ex-dividend)	11⅛	12⅜
Philadelphia Rapid Transit	30¼	30¼
Philadelphia Traction	90	91
Union Traction	54	54⅜

CHICAGO.	Aug. 23.	Aug. 16.
Chicago Railways, Series 1	108	108
Chicago Railways, Series 2	37¼	38⅛
Chicago Subway	19½	20½
Chicago Telephone	135½	135½
Commonwealth Edison	120⅞	121
Metropolitan Elevated common	15⅛	17¾
Metropolitan Elevated preferred	49	49
National Carbon common	95	98
National Carbon preferred	119	119

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

CHARLOTTE, N. C.—The Carolina Automobile Company has been incorporated at Charlotte by E. A. and C. A. Robbins and others, capital stock $30,000, to deal in, sell, rent or manufacture, automobiles. L.

CHICAGO, ILL.—The Western Telephone Manufacturing Company has been incorporated to manufacture telephone apparatus. The capital is $25,000 and the incorporators are H. E. Anderson, H. E. Simonton and H. P. Simonton.

CAMDEN, N. J.—The Phoenix Meter Company has been incorporated to manufacture meters for water, gas and electric service, with a capital of $60,000. The incorporators are G. H. Hobdell, L. A. Stecklair and G. E. Lucas, of Camden.

NEW YORK, N. Y.—The New York Self-Winding Electric Clock Company has been incorporated to manufacture electric clocks, batteries, etc. The capital is $50,000, and the incorporators are S. W. Livingston, H. A. St. George, C. R. Frazier, New York city.

ANDERSON, IND.—The Welchel Electric Company has filed articles of incorporation with the secretary of state. The capital stock is $25,000, divided into 250 shares of par value of $100 each. The object of the corporation is to establish and equip a factory to manufacture magnetos and general electrical appliances and electric machines and in connection carry on a general repairing business of electrical appliances and machines of all kinds. Bert Welchel, John W. Jones, Albert S. McCall and John Ricks, incorporators. S.

PERSONAL MENTION.

DR. H. W. WILEY, chief of the United States Bureau of Chemistry, has been awarded the Cross of the Legion of Honor by the French Government.

PROF. F. B. CROCKER, of the electrical department of Columbia University, has obtained leave of absence and will start in October on a trip around the world.

DR. J. FRANKLIN MEYER, formerly professor of physics at the Pennsylvania State College, has resigned from that institution to accept a position with the Westinghouse Lamp Company, Bloomfield, N. J., in charge of the physical research.

F. C. ARMSTEAD, supervising engineer of the stoker department of the Westinghouse Machine Company, who, for a number of years, has been located at East Pittsburg, Pa., has moved his headquarters to the Westinghouse Works, Attica, N. Y., where the stokers are manufactured.

RALPH W. POPE, secretary of the American Institute of Electrical Engineers, arrived in Chicago on August 19, on the Twentieth Century Limited, going directly on to Seattle via the Chicago, Burlington & Quincy and Canadian Pacific Railway. Mr. Pope has been delegated to represent the Institute at the first national conservation congress at the Alaska-Yukon-Pacific Exposition, August 26, 27 and 28. Mr. Pope will also represent the Institute at the joint meeting at the Seattle section of the Institute and the Northwest Electric Light and Power Association September 7, 8 and 9. After this meeting he will visit and address sections at Portland, San Francisco and Los Angeles. He has arranged to meet the members of the Institute at Vancouver, B. C., Salt Lake City and Provo, Utah, and Telluride and Denver, Colo. While at Denver, Mr. Pope will attend the convention of the American Street and Interurban Railway Association and the convention of the Colorado Electric Light, Railway and Power Association. President Stilwell believes that this tour will be of very great benefit to the Institute, and Mr. Pope's present visit will be followed during the coming season by considerable attention to the sections in the Central States. Recently Mr. Pope has attended meetings at Boston and Philadelphia and taken a leading part in the smokers and dinners at Washington, Pittsfield and Schenectady.

OBITUARY.

CHARLES S. KNIGHT, for many years prominently identified with the electrical business throughout the country, died at his home in Fort Wayne, Ind., August 14. In the early '80's Mr. Knight was manager of the Fort Wayne Gas Company. In 1885 he became associated with the late R. T. McDonald in the old Fort Wayne Electric Company and was vice-president and sales manager of that company until 1898, when he removed to Chicago to become general manager of the Siemens & Halske Electric Company. After this company was sold to the General Electric Company, Mr. Knight returned to Fort Wayne and for the past several years devoted his time to his mining interests.

INDUSTRIAL ITEMS.

FRANK W. PARDEE, of 56 Fifth Avenue, Chicago, has just been appointed western agent of the Sundh Electric Company, of 113 Cedar Street, New York city, makers of all kinds of motor controllers, starters and rheostats.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, states that the company's business for the first six months of this year was considerably ahead of the business transacted during the same period of 1908. The company's fan business so far this year has been extraordinarily large. The Metropolitan company, which supplies everything electrical, now carries a more complete stock than ever. W. H. McKinlock, the president, anticipates a heavy fall trade, which his company will be well prepared to handle.

THE NERNST LAMP COMPANY, Pittsburg, Pa., in a circular letter over the signature of its president, George Westinghouse, announces that the receivers appointed October 24, 1907, by the Circuit Court of the United States for the Western District of Pennsylvania, were on July 24, 1909, discharged by the same authority. H. T. Herr has been made vice-president, and W. D. Uptegraff vice-president and general manager. Business will, of course, be continued uninterruptedly, and the company's position has been greatly strengthened by the temporary receivership.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual convention, Briarcliff, N. Y., August 31 to September 3, inclusive.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 17, 1909.

931,033. LIGHTNING-ARRESTER. William E. Butler, David City, Neb. Filed July 16, 1908. A bare circuit terminal is separated by an air gap from a grounded body of mercury and by insulating material of small thickness, bridging the gap.

931,034. X-RAY APPARATUS. Eugene W. Caldwell, New York, N. Y. Filed March 5, 1906. An X-ray tube is mounted in front of an impervious shield for the operator.

931,055. AUTOMATIC TELEGRAPH AND SELECTIVE SYSTEM THEREFOR. Alfred C. Gilmore, Chicago, Ill., assignor to James H. Peirce, trustee, Chicago, Ill. Filed October 6, 1904. An electrically-operated step-by-step controller acts in response to the varied number and order of impulses in the different code combinations for effecting the shift of a series of independently shiftable selectors.

931,065. ELECTRICAL INTERRUPTER FOR EXPLOSIVE-ENGINES. Gottlob Honold, Stuttgart, Germany. Filed December 18, 1905. Has one fixed and one movable electrode.

931,066. ELECTROMAGNETIC IGNITER FOR EXPLOSION-ENGINES. Gottlob Honold, Stuttgart, Germany. Filed August 7, 1906. Describes an electromagnetic igniter.

931,068. GALVANIC SOLE. Frank Kennedy and Joseph V. Davis, Bournemouth, England. Filed August 8, 1908. A grid is formed of dissimilar metallic wires.

931,072. AUTOMATIC TELEPHONE-EXCHANGE SELECTOR. Frederick H. Loveridge, Chicago, Ill., assignor to Western Electric Company. Filed August 2, 1906. A carriage, on which is mounted a rotatable contact arm, is adapted to move on vertical guide rods, and means are provided for rotating the contact arm to select one of a series of vertical rows of terminals and to move the carriage to bring the arm to a desired terminal in the selected row.

931,081. PROCESS OF PREPARING STORAGE-BATTERY ELEMENTS. David P. Perry, Chicago, Ill., assignor of two-thirds to William Morrison, Chicago, Ill., and one-third to M. A. Lumbard, Des Moines, Iowa. Filed December 26, 1903. Copper and cadmium are suitably dissolved together and hydrates of the metals precipitated, from which their oxides are prepared and obtained in a suitable support.

931,082. PROCESS OF PREPARING ALKALINE ELECTROLYTES FOR STORAGE BATTERIES. David P. Perry, Chicago, Ill., assignor of two-thirds to William Morrison, Chicago, Ill., and one-third to M. A. Lumbard, Des Moines, Iowa. Filed December 26, 1903. Renewed March 18, 1908. The process consists in placing an alkaline zincate electrolyte in a storage battery, charging the battery, pouring off the solution and washing out the battery, and then replacing the solution thus poured off with an electrolytically purified alkaline solution and then discharging the battery.

931,092. ELECTROLYTIC PRODUCTION OF MAGNESIUM. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Company, New York, N. Y. Filed March 28, 1906. Magnesium is produced by electrolyzing fused magnesium chloride to which is added enough of a denser alkali-earth chloride to render the bath heavier than the separated magnesium.

931,105. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed September 8, 1908. Comprises a series of commutator disks having a plurality of wedge-shaped blocks or segments, and means for electrically connecting the corresponding segments of the several commutator disks together.

931,114. SYSTEM FOR VAPOR ELECTRIC APPARATUS. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. In combination with an alternating-current circuit, and a current-rectifying device, is a transformer interposed between the circuit and the device and embodying means for introducing inductance into both the primary and secondary circuits.

931,115. SYSTEM OF DISTRIBUTION FOR MERCURY-VAPOR RECTIFIERS. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 6, 1907. Renewed March 8, 1909. Uses a special form of transformer in combination with a rectifying device.

931,116. DYNAMO-ELECTRIC MACHINE. Joseph D. Forrer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufac turing Company. Filed October 7, 1908. Comprises a stationary frame, a rotatable member having clamping bolts arranged with their center lines parallel to the axis of rotation and an annular member having a cylindrical surface for locking the bolts against independent rotation.

931,124. CURRENT-RECTIFYING APPARATUS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 9, 1908. A transformer comprising a magnetizable core has two legs, a plurality of coils surrounding each core leg, those occupying intermediate positions being subdivided, and leakage paths of relatively low reluctance between coils.

931,126. CONTROL SWITCH AND SYSTEM. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. An electrical switch is provided with a blow-out coil, etc.

931,127. TELEPHONE-TRANSMITTER. Adolph G. Kaufman, New York, N. Y., assignor to American Callaphone Company, New York, N. Y. Filed August 28, 1907. Resilient means are provided whereby a device for vertically adjusting telephone transmitters may be supported, and a sound-insulating means is interposed between the adjusting device and the transmitters.

931,130. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 7, 1908. Comprises a number of notched bars or segments radially disposed and separated by relatively short wedge-shaped blocks located adjacent to the notches and electrically connected in longitudinal rows.

931,132. MEASURED-SERVICE AUTOMATIC TELEPHONE-EXCHANGE SYSTEM. Winfield W. Leach, Chicago, Ill., assignor to Rhoda A. Leach, Chicago, Ill. Filed October 15, 1906. Automatic line-switching mechanism is operative upon deposit of a coin.

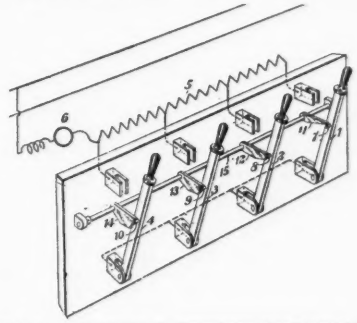
931,133. ARC-LAMP ELECTRODE. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. One electrode contains a material which is a conductor when fused, and the other a granulated alloy of iron and chromium.

931,166. VARIABLE-SPEED ALTERNATING-CURRENT MOTOR. Ralph D. Mershon, New York, N. Y. Filed May 28, 1906. Comprises a primary winding having poles produced therein; a secondary element adapted to have current induced therein corresponding to poles in the primary winding, and capable of inducing other poles in the primary winding; means for closing the circuit or circuits of current induced in the primary winding; and means for regulating such induced current or currents.

931,138. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed November 23, 1907. Switching mechanism at each station connects the telephone set of that station to the trunk line and controls the magnetization or demagnetization of a differential relay.

931,148. MULTIPLE-SWITCH RHEOSTAT. Otto S. Schairer, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. Comprises a series of independently actuated switches, and interconnected dogs mounted for rotative movement to prevent each switch, except the first of the series, from closing unless the next preceding switch is closed.

931,150. WINDING OF ARMATURES FOR ALTERNATING-CURRENT MOTORS. Bennet C. Shipman, Baltimore, Md. Filed January 29, 1906. An auxiliary winding for the armature has sections which are independent and symmetrically disposed, and serve as connections from the junctions of the sections of the main armature winding to the commutator.



931,148.—MULTIPLE-SWITCH RHEOSTAT.

931,156. WINDING FOR DYNAMO-ELECTRIC MACHINES. Hans C. Specht, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed July 26, 1906. In an induction motor are a relatively slow speed winding, and an auxiliary winding adapted to produce a fraction of the number of poles produced by the slow speed winding and having one end connected to an intermediate point in the slow speed winding.

931,157. ELECTRIC SELF-WINDING CLOCK. Jacob Steiger and James Besancon, La Chaux-de-Fonds, Switzerland. Filed February 11, 1907. Is automatically wound by an electric motor.

931,162. ADJUSTABLE DROP-LIGHT BRACKET. Perry L. Tenney, Alameda, Cal. Filed October 31, 1908. Has an S-shaped friction wire-engaging member mounted on an arm secured to the lamp holder.

931,168. ARC-LAMP. Samuel P. Wilbur, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. A cut-out switch establishes a circuit in shunt to the arc, and a magnetic winding maintains the switch in closed position when the electrodes are separated.

931,169. ELECTRODE FOR ARC-LAMPS. Samuel P. Wilbur, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. A tubular arc lamp electrode of uniform diameter from end to end is provided with lateral apertures adjacent to one end and with a hood that surrounds the apertured end.

931,175. SAFETY ELEVATOR MECHANISM. Harry O. Barnes, Lansing, Mich. Filed February 18, 1909. Comprises a main electric circuit, an alarm in this circuit, a shunt circuit to cut out the alarm, an elevator car, means carried by the car to open and close the shunt circuit, doors, and means carried by the doors to open and close the shunt circuit.

931,179. TELEPHONE DESK-STAND. Jules A. Birsfield, Chicago, Ill., assignor to Alfred Stromberg, Chicago, Ill. Filed October 24, 1906. A telephone desk stand includes a tubular shaft, a cap piece threaded upon the shaft, and a hook-supporting cross member in the cap and locked by the engagement therewith of the end of the shaft.

931,188. ADVERTISING-SIGN. James W. Ellis, Denver, Colo., assignor to the Ellis Electric Sign Company. Filed July 28, 1908. Describes the details of an electric-lamp sign device.

931,202. SWITCH-KEY. Newman H. Holland, Chicago, Ill., assignor to Western Electric Company. Filed November 23, 1907. An additional contact, or contacts, is, or are, depressed by a main plunger when the latter is partly depressed.

931,205. CONTROL SYSTEM AND SWITCH. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. In combination with separable contact terminals is a blow-out magnet with a movable armature or core.

931,231. MOUNTING FOR TELEPHONE INSTRUMENTS. Herbert E. Shreeve, Wyoming, N. J., assignor to American Telephone and Telegraph Company. Filed August 21, 1908. A back-plate secured to the casing is provided at one end with a suspending means and at the other with an angular portion extending over the side of the casing, and a handle is attached to the angular portion.

931,242. AUTOMATIC POLE-CHANGER. Frank H. Williams and Charles W. Welch, Greene, N. Y. Filed March 8, 1907. De-

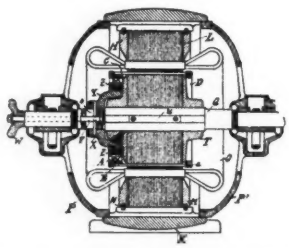
scribes in detail a pole-changing apparatus for the signaling circuit of a telephone system.

931,264. CIRCUIT-BREAKER. Robert L. Browne and Alexander R. Howell, New York, N. Y. Filed May 11, 1906. A liquid column of low conductivity connects two of a number of conductors and is adapted to divide the current passing therethrough until the path through one of the conductors is broken, and to be volatilized by the current after the path is broken, and an insulating substance is adapted to displace the liquid column upon the volatilization of the latter and to open the circuit.

931,281. ELECTRICAL MUSICAL INSTRUMENT. George H. Davis, Llewellyn Park, West Orange, N. J. Filed June 3, 1903. A note-selecting device comprises a longitudinally movable bar carrying a number of selector fingers and a contact member common to all of these fingers and with which they are adapted to make contact, and means for moving the bar longitudinally relatively to the contact member.

931,292. TROLLEY AND SUPPORT THEREFOR. Samuel S. Goldman, St. Louis, Mo., assignor of one-fourth to Charles J. Malecek, St. Louis, Mo. Filed September 14, 1908. The harp has a pair of side arms in which is mounted a shaft provided with an oil duct; a journal sleeve carried by the shaft has a convex external surface and is provided with an oil duct in communication with the oil duct in the shaft; and a trolley wheel is provided with a box surrounding the journal sleeve and having a concave journal surface for contact with the convex surface of the journal sleeve.

931,301. TROLLEY-WIRE HANGER. Roland B. Heimbecker, Wilkinsburg, and Samuel R. M. Orum, Philadelphia, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed February 24, 1908. Comprises a rod, a single-piece gripping member having crossed integral jaws, and means for producing a clamping action between the jaws.



931,302.—INDUCTION MOTOR.

931,302. INDUCTION MOTOR. Rudolf E. Hellmund, Pittsburg, Pa., assignor to Hellmund-Collbohm Electric Company. Filed December 4, 1907. Describes a form of squirrel-cage motor.

931,307. PRIVATE-BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. Newman H. Holland, Chicago, Ill., assignor to Western Electric Company. Filed November 23, 1907. A single-ringing key at each of two or more of the stations applies ringing current to the local circuits and also serves as a transfer key to produce circuit connections for maintaining the circuit for direct current on the trunk line when the telephone set at a particular station is connected to the trunk line.

931,330. TELEPHONE-EXCHANGE SWITCHBOARD APPARATUS. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed March 8, 1906. A line-signal magnet has two windings, one in each line conductor, disposed in close inductive relation to each other, and a connection switch is adapted to establish a second telephone circuit in shunt in one of the windings. The windings are included in the talking circuit and connected to neutralize one another with respect to telephone currents in the united circuit flowing through the magnet.

931,331. TELEPHONE-KEY. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed November 23, 1907. In combination with a number of spring-retracted plunger rods, each provided with a contact operating plunger, are contacts individual to each plunger and arranged to be operated thereby, a plate co-operating with the plungers for locking the plunger rods, a contact common to the plunger rods, and a second plate movable by the plungers to control the common contact.

931,336. PROCESS AND APPARATUS FOR PRODUCING DIRECT CURRENTS HAVING LIMITED STRENGTH. Menahem M. Osnos, Frankfort-on-the-Main, Germany, assignor to firm of Felten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Filed October 29, 1907. A direct-current dynamo has an over-compensating coil and a second coil for regulating the action of the first coil, and means whereby the electromotive-force produced in the armature by the over-compensating coil opposes the flow of current in the main field upon an increase of the working current.

931,345. TROLLEY-CLAMP. Edward E. Rose, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 6, 1907. Renewed June 24, 1909. Has a pair of detachably hinged jaws with projecting shanks forming a screw-threaded tapered sleeve into which is screwed a hanger rod to separate the shanks.

931,353. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 1, 1905. A supporting hanger for an electrical conductor comprises an extensible body member having a screw-thread upon its lower end, a pair of clamping jaws having external screw-threads, and an internally threaded sleeve which engages the body member and the jaws.

931,354. OVERHEAD-LINE CONSTRUCTION FOR ELECTRIC RAILWAYS. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. Trolley conductor clamps are situated at the respective ends of longitudinally disposed insulating bars and a metal-clamping means supports and spaces the bars in pairs from the wire or cable.

931,355. TROLLEY-CLAMP. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 6, 1907. Comprises a cup having end walls and downwardly and inwardly tapering side walls, a pair of jaws having flaring shanks the ends of which are located in the cup, and a hanger rod adapted both to force the jaws together and to suspend the cup.

931,356. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 9, 1908. A hanger for electric lines comprises two clamping members and two hinge-connected links which are respectively hinge-connected to the clamping members.

931,357. TROLLEY-CLAMP. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 6, 1908. A trolley wire clamp comprises two hinge-connected members forming jaws at one side and a double-tapering split socket at the other side of the hinge-connections, and means adapted to engage the tapering walls of the socket to close the jaws.

931,358. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 31, 1908. Two hinge-connected members are interposed between two relatively offset clamps and means are provided for limiting relative movement of the hanger to a small angle in the plane of the clamps.

931,366. TROLLEY-HANGER AND CLAMP. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. The hanger comprises a rod, two complementary members having hollow body portions and jaws and provided with segmental sleeve projections to embrace the rod, and means co-operating with the rod to force the jaws toward each other.

931,367. HANGER AND CLAMP FOR WIRES AND CABLES. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. The hanger comprises a rod, two complementary jaw members, one of which has a hollow body portion and a beveled outer end surface and the other of which has a projection located within the hollow body portion and into which the end of the rod is screwed, and a nut mounted on the rod to engage the beveled end surface.

931,368. CLAMP FOR TROLLEY-CONDUCTORS. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. Has a hanger rod, a clamping member with side wings to engage the inclined outer surfaces of the complementary end projections of interchangeable jaw members, and means to draw the latter and the clamping member toward each other in order to produce a clamping action between the jaws.

931,375. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company and Allis-Chalmers Company. Filed September 19, 1904. Describes a form of high-speed rotating-field dynamo-electric machine.

931,377. AUTOMATIC FIRE-ALARM. Pietro Bonini, New York, N. Y. Filed August 13, 1908. Describes a form of thermostat.

931,380. PUSH-BUTTON APPARATUS. Ralph D. Burk, New York, N. Y. Filed October 4, 1907. Comprises a manually-operated, normally spring-retracted, push-button device, acting in co-operation with a ratchet and a magneto.

931,384. MOTOR-CONTROLLER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed February

29, 1908. A rotatable drum having off, starting and running positions is provided with means for releasing it from the spring that tends to move it back from the starting to the off position.

931,385. SECTION-INSULATOR. Henry B. Clarke, Highland Park, Ill. Filed May 21, 1906. Describes a section insulator for trolley wires.

931,390 and 931,391. TROLLEY-CLAMP. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 5, 1907. Describes a kind of jaw clamp for wires or cables.

931,392. TROLLEY-HANGER. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 10, 1908. A triangular supporting frame has cable clamps at two corners, a sleeve member at the other corner and means for suspending a gripping sleeve in the sleeve member to permit a certain amount of play.

931,393. TROLLEY-CONDUCTOR HANGER. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. In combination with a messenger wire or cable and a trolley conductor, are a cable clamp, a trolley-conductor clamp comprising a pair of interchangeable jaw members having shanks projecting therefrom to form a loop and a single link pivotally secured to the cable clamp and interlinked with the trolley-clamp.

931,397. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. Comprises two jaw members having interlacing teeth and divergent sides, clips which embrace the upper edges of these members, and means for preventing accidental removal of the clips.

931,398. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed December 9, 1907. A clamp is provided for the trolley wire and a gripping device for the supporting wire, also a single fastening means for the clamp and the gripping device.

931,399. CABLE-HANGER CLAMP. Samuel B. Dusinberre, Pittsburg, Pa., and George B. Dusinberre, Cleveland, Ohio, assignors to Westinghouse Electric and Manufacturing Company. Filed December 9, 1907. Comprises a bar having a longitudinal slot, and a leverage member having a neck located in the slot, also a head provided with means for preventing enlargement of the slot.

931,400. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed February 25, 1908. In combination with a pair of crossed bell crank levers having interlacing jaw teeth are means for exerting pressure upon both arms of these levers to close the jaws.

931,404. SYSTEM OF ELECTRICAL DISTRIBUTION. Budd Frankenfield, Norwood, Ohio, assignor to Allis-Chalmers Company, and to the Bullock Electric Manufacturing Company. Filed March 30, 1907. A number of motors are mechanically connected to rotate at proportional speeds and to drive a common load and having their armatures connected in parallel, and a shunt field winding for each of these motors is connected in series with a shunt field winding of another of the motors.

931,408. LIGHTNING-ARRESTER. William Gifford, Traverse City, Mich. Filed July 24, 1908. Has an impedance coil provided with a core of magnetic material, which core is included in the circuit between the line and the instrument to be protected, and an air gap is included in a ground branch connected to the line on the line side of the impedance coil.

931,412. GAS-LAMP LIGHTING AND EXTINGUISHING SYSTEM. August Grossmann, Rheydt, Germany, assignor to Kabelwerk Rheydt Actien-Gesellschaft, Rheydt, Germany. Filed December 16, 1908. A spark gap for each burner is included in the secondary circuit of an induction coil, and electromagnetic means are provided for sending a number of consecutive impulses through the conductors.

931,415. BRUSH-HOLDER FOR MOTORS. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed January 22, 1908. Has a yoke-shaped member of spring sheet metal and a brush-holding member also of sheet metal and engaged with the yoke member, the engagement permitting a rocking of the brush-holding member relative to the yoke member.

931,416. ELECTRIC MOTOR. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed January 22, 1908. Describes a compact form of small two-pole motor.

931,417. ELECTRIC TOY MOTOR. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed June 6, 1908. A cover supported by the frame has a disk with a projection on it adjustable relative to the cover, and a gear wheel carried by the disk and engaging a gear wheel on the armature shaft.

931,425. TELEGRAPH AND TELEPHONE POLE. John H. Hile, Belton, Ark. Filed August 4, 1908. Describes a form of composite pole of metal rods supported on a plastic base.

931,427. ELECTRIC GAS-IGNITING DEVICE. Henry Jameson, Joplin, Mo. Filed June 17, 1908. Describes a jump-spark ignition device.

931,445. ELECTROMAGNET-COIL CONSTRUCTION. Abbot A. Low, Horseshoe, N. Y., assignor to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed December 12, 1908. The coil is wound with alternate turns of copper wire and aluminum wire, one partially inclosed by the other.

931,448. DYNAMO-ELECTRIC MACHINE. Emil Mattman, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed January 30, 1909. The rotor has an armature winding, commutator segments, and flat commutator leads connecting the former with the latter, the planes of these leads making an angle with the axis of rotation.

931,452. TELEPHONE-TRANSMITTER MOUTHPIECE. Robert E. Miller, Dayton, N. M. Filed September 24, 1908. A screened space is provided for disinfecting material.

931,464. METERING PANEL-BOARD. Arthur C. McWilliams, Chicago, Ill. Filed June 29, 1907. Two rows of electrically connected sockets (with a contact for each) extend alternately to opposite sides of the board, the contacts being arranged in rows transverse to the rows of sockets and the contacts of a single row belonging to two different groups, the members of a group being electrically connected together.

931,476. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed July 8, 1908. Has a sheath with conductors and between the conductors a link in accordion-like folds lengthwise of the link.

931,477. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed December 17, 1908. Has a sheath with conductors and between the conductors a link piece, the edges of which are cut away to form a fusing point, intermediate the ends and the latter rolled.

931,478. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed December 17, 1908. Comprises a sheath with conductors and between the conductors a link having its edges lengthwise of its axis rolled up to form, in cross-section, a figure 8, the conductors serving to close the ends of the chambers in the link so formed.

931,507. INSULATOR FOR ELECTRIC WIRES. Aaron V. Siler, Newark, Ohio, assignor of one-half to Andrew Jasper Siler, Massillon, Ohio. Filed June 9, 1909. The body has therein a slot with a convex bottom between which and pins projecting through from the side of the body is gripped the line wire.

931,513. ELECTRODE. Heinrich Specketer, Griesheim, Germany, assignor to Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany, a corporation of Germany. Filed March 21, 1907. Describes a process of manufacturing electrodes for electrolytic purposes which consists in adding to molten triferrous tetroxide, while it is still in a liquid state, such metal oxide as will result in forming a homogeneous crystallizing melt, and pouring the mixture into suitable molds, allowing it to cool and solidify superficially, inserting in the center molten portion of the mass a rod of good conducting material and then permitting the mass to harden.

931,518. ELECTRICAL APPLIANCE. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Filed January 29, 1908. Describes a form of terminal device.

931,521. OUTLET-BOX CONSTRUCTION. Emmett W. Stull, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed April 15, 1909. Describes an outlet box for electric cars.

931,540. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed April 21, 1908. A solenoid or coil adapted for use in an arc lamp is wound with aluminum wire and comprises a number of layers, insulation between the layers consisting of a composite strip which has a central layer of insulating material and outer layers of readily combustible material.

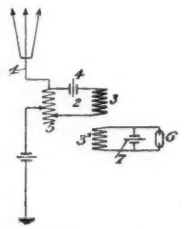
931,541. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed November 18, 1908. Describes a method of mak-

ing an electromagnet coil which consists in winding a number of layers, each layer having successive turns of a conducting winding alternately positioned with successive turns of an insulator, and successively winding upon the layers a composite strip comprising a central layer of insulating material and outer layers of combustible material.

931,542. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed November 18, 1908. Describes a method of making an electromagnet coil which consists in winding a number of layers, each layer having successive turns of a conducting winding positioned within an insulating winding, and successively winding upon the layers a composite strip comprising a central layer of insulating material and outer layers of combustible material.

931,547. RENT-COLLECTING MEANS FOR TELEPHONE SERVICE. Richard Yearneau, Clark, S. D. Filed October 8, 1908. An electrically controlled toll mechanism.

931,548. ANNUNCIATOR-BOARD. Julius Zickel, Berlin, Germany. Filed January 14, 1909. A series of electromagnets is arranged in a circle. Annunciator disks associated with the magnet armatures are journaled in circularly arranged bearings.



931,586.—RECEIVER FOR WIRELESS TELEGRAPHY AND TELEPHONY.

931,556. DYNAMO-ELECTRIC MACHINE. Herbert A. Balcome and Anton Freier, Boston, Mass., assignors to Holtzer-Cabot Electric Company. Filed February 10, 1908. An enclosing frame is of sheet steel divided in two parts and carries the armature bearings and supports the laminated field.

931,573. CONNECTION-BOARD FOR ELECTRIC MACHINES. John G. Crawford, La Grange, Ill., assignor to Western Electric Company. Filed September 8, 1906. The board is made of two similar castings of insulating material having a series of recesses for terminal lugs that lie freely therein and are held against removal therefrom.

931,586. RECEIVER FOR WIRELESS TELEGRAPHY AND TELEPHONY. Simon Eisenstein, Kiew, Russia. Filed March 27, 1908. Combined with a resonant circuit is a primary receiving transformer coil, a secondary transformer coil outside the circuit arranged to be continuously moved into and out of the field of the primary coil, and a detector connected with the secondary coil.

931,592. TROLLEY-HARP. Thomas A. Gannoe, Warren, Pa., assignor of three-eighths to John Schmutz, Warren, Pa. Filed April 1, 1908. The pressure between the trolley wheel and overhead wire normally keeps a wheel guard depressed.

931,594. FLAME INDICATOR FOR FURNACES. Frederick Gelstharp, Ford City, Pa. Filed December 26, 1908. An electric circuit is closed when its terminals in the furnace are in contact with a reducing atmosphere and broken when the terminals are surrounded by an oxidizing atmosphere.

931,604. SIGNAL DEVICE. Henry J. Heeney, Boston, Mass., assignor to Holtzer-Cabot Electric Company. Filed October 10, 1907. A fire-alarm box has a glass door which must be broken before the electric alarm can be actuated.

931,605. ELECTRICALLY-HEATED GRATE. Marcus Hermansen and Andrew Tygerson, Ephraim, Utah. Filed May 11, 1908. Between two pipes containing the heating coils are transverse rods forming the grate.

931,606. DYNAMO-ELECTRIC MACHINE. Fritz E. Hirt, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed May 1, 1909. Describes the construction of the collector rings and connections thereto from the windings through an end cover for the projecting portions of the winding.

931,613. TRAIN-LIGHTING SYSTEM. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William B. Jackson, Madison, Wis. Filed May 5, 1906. In connection with an axle-driven alternating-current generator is a rotary converter for charging storage batteries that carry the lighting load of the train and also operate the converter from the direct-current end when the generator has stopped, or is running below speed, until it has attained the speed again where it automatically synchronizes with the converter.

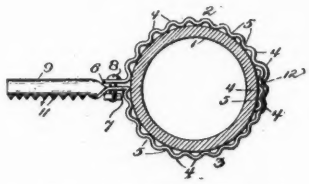
931,617. ELECTRIC TIME-SWITCH. James Jones and James Jones, Jr., New York, N. Y. Filed March 10, 1908. Two cam-disks connected with the clock mechanism operate hammer levers that release the spring switch.

931,620. DYNAMO-ELECTRIC MACHINE. Walter S. Kelley, Brookline, Mass. Filed February 10, 1908. The field structure of a multipolar machine is laminated and held together between two annular end frames that are secured by bolts passing through tubes across the laminas.

931,632. ELECTRIC SIGNALING. Johann Mládek, Prague, Austria-Hungary. Filed April 19, 1907. In telegraphy by induced currents of opposite polarity the receiver has a sensitive easily springing contact device arranged in its core.

931,661. TELEGRAPH-POLE ARM. Lee Tyreman, Stroudsburg, Pa., assignor of one-half to William H. Lawell, Stroudsburg, Pa. Filed October 15, 1908. The cross arm is made of a channel iron having pivoted clamping members passing around the pole and swinging in between the flanges of the channel when not in use.

931,704. SUPERVISORY SIGNAL SYSTEM. Charles F. Patterson, New York, N. Y. Original application filed June 14, 1906. Divided and this application filed January 17, 1907. Relates to the supervisory signals of a telephone switchboard.



931,706.—ELECTRIC GROUND-CLAMP.

931,706. ELECTRIC GROUND-CLAMP. Frank Stevens, Philadelphia, Pa., assignor to George F. Stevens, Philadelphia, Pa. Filed June 4, 1908. A ground clamp for attachment to pipes comprises two corrugated sections, a bolt securing the ends of the sections together, a tubular socket on one of the sections for the reception of the conductor wire, and teeth on the socket member for biting the wire.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 23, 1909:

481,220. ELECTRIC MOTOR AND GENERATOR. C. S. Bradley, Avon, N. Y., and J. J. Wood, Fort Wayne, Ind.

481,223. SHIP'S TELEGRAPH. A. B. W. H. Cords, Hamburg, Germany.

481,246. THERMAL CUT-OUT. A. P. Seymour, Syracuse, N. Y.

481,247. TELEGRAPHY. J. G. Smith, New York, N. Y.

481,284. TELEPHONE. A. Rettig, Saarbrucken, Germany.

481,285. SHADE FOR INCANDESCENT ELECTRIC LAMPS. C. J. Salick and E. Sipp, Watertown, Wis.

481,288. REFLECTING SHADE FOR INCANDESCENT ELECTRIC LAMPS. L. T. Stanley, Brooklyn, N. Y.

481,291. ELECTRIC WATER HEATER. T. Ahearn, Ottawa, Canada.

481,297. ELECTRIC SWITCH. J. H. Clark, Boston, Mass.

481,386. ELECTRIC ELEVATOR. Wm. Baxter, Jr., Baltimore, Md.

481,401. TROLLEY FOR ELECTRIC RAILWAYS. W. F. Jenkins, Richmond, Va.

481,402. TROLLEY FOR ELECTRIC-RAILWAY CONDUITS. W. F. Jenkins, Richmond, Va.

481,403. CONDUIT FOR ELECTRIC RAILWAYS. W. F. Jenkins, Richmond, Va.

481,430. PNEUMATIC ELECTRIC-CIRCUIT CONTROLLING AND INTERLOCKING APPARATUS. W. W. Slater and H. C. Barnes, Oakland, Cal.

481.457. INSULATOR. A. J. Wylie, Rome, N. Y.

481,483. TELEPHONE SYSTEM. R. N. Dyer, East Orange, N. J.

481,529. TELEPHONY. J. W. Gibboney, Lynn, Mass.